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Vol 2
Feb 1, 1859 - Nov 27, 1890.

PROCEEDINGS
OF THE
Elliott Society of Science & Art.
OF
CHARLESTON, SOUTH-CAROLINA.
VOL. II.

FEBRUARY 1st. 1859.

Vice-President W. W. **Smith** in the chair.

Contributions to Library.

Prodromus Descriptionis Animalium Evertebratorum &c. Pars VII. W. Stimpson. *Presented by the Author.*

Hints to Craniographers, J. Aitken Meigs, M. D. *Presented by Mr. Wm. Stimpson.*

Prof. McCrady referring to the earthquake shock felt in this City Dec. 19th, 1857, said that at the time he was on Sullivan's Island, near the mouth of the Harbor, whither he had gone for the purpose of collecting marine animals. At that time of the year the village of Moultrieville has only empty houses and consequently the stillness, was all that could be desired. At about 9 A. M. his attention was attracted by a deep rumbling noise, having much the character of a prolonged roll of thunder, but of more equal successive impulses. He was at once impressed with the idea of the true cause from the peculiar character and rapidly increasing volume of the sound, which appeared to him to be approaching from the South West. This deep rumbling sound proceeded from the earth and was all that was perceived, while the shock was passing under the waters of the Harbor. But no sooner did it reach the outskirts of the village, than a loud rattling din was added to it, produced by the strong vibrations of the houses, shutters, sashes and doors especially the glass window panes emitting similar sounds to those produced by a sudden and violent gust of wind but proceeding he thought at a less rapid rate from house to house, than such gusts usually do. This of course was only his impression, as it was not possible in the very short space of time, to form a deliberate mental estimate, still less to observe data for subsequent computation. The earth wave appeared to strike first the South West angle of the building, and it consisted of a rapid succession of distinct shocks. He very clearly observed the composite character of the wave. It was not one shock, but at least five or six in rapid succession. The sensation produced was one of very slight nausea, and desire to get into the open air. It was Mr. McCrady's impression that there were two sets of vibrations one vertical and one horizontal. There was no clattering or rattling in the sound except when the shock passed the village, the deep lumbering rumble being the sound emitted by the earth, and heard as distinctly different from the clatter of the houses.

Prof. Gibbes exhibited specimens of *Selaginella convoluta*, and *Lycopodium squamatum*.

MARCH 1st, 1859.

Vice-President Smith in the chair.

Contributions to the Collection.

Hydnum trichodontum; Lenzites vitulina; and a *Stereum*, presented by Prof. L. R. Gibbes.

Contributions to the Library.

Hints to Craniographers, J. Aitken Meigs, M. D.

Mosaic account of the Creation, James C. Fisher. M. D.

Proceedings of the Academy of Natural Sciences Philadelphia Nos. 14–20 (Oct.–Dec. 1858) and No. 1, (Jan. 1859)

Descriptions of Unionidæ &c., by Isaac Lea, LL. D. *Presented by the Author.*

Verhandlungen der Zoologisch-botanischen Vereins in Wien. Band VII. Jahrgang 1857. *From the Society* and accompanied by a letter, soliciting exchange. Accepted, and thanks of the Elliott Society tendered for this donation.

Personen-, orts- und sachs-register der fünf ersten Jahrgänge (1851–1855) der Sitzungs-bericht und Abhandlungen des Wiener Zoologish-botanischen Vereins. Wien, 1857. *From the Society.*

A letter was read from Dr. James Moultrie, tendering his resignation from the Presidency of the Society. Accepted.

MARCH 15TH, 1859.

Vice-President SMITH in the chair.

Prof. L. R. Gibbes exhibited seeds of the *Palmetto* perforated by a Coleopterous insect.

Mr. McCrady exhibited specimens of Copper Ores from the Alleghany Mine lying partly in Tennessee and partly in Georgia.

It was resolved that a meeting of the Committee of Curators be called by their Chairman, at an early day to take into consideration the subject of the establishment of a Journal separate and distinct from the published proceedings, and destined to contain all papers whose length may render their insertion in the Proceedings inconvenient.

APRIL 1ST, 1859.

Vice-President SMITH in the chair.

Contributions to the Library.

Report on the History and Progress of the American Coast Survey up to the Year 1858. *Presented by Prof. L. R. Gibbes.*

The Chairman read a circular from the California Society of Natural History, Stockton, requesting correspondence and exchange. Agreed to—and the Corresponding Secretary instructed accordingly.

Dr. J. F. M. Geddings reported the action of the Committee upon the establishment of a Journal, distinct from the Proceedings now published and in accordance with a plan suggested at the last meeting. The committee after careful consideration had concluded to report favorably upon this suggestion, and on the plan of the proposed Journal. Report adopted.

The Committee on publications reported the completion of the First volume of the Proceedings of the Society containing about 300 pages and 14 plates.

It was resolved upon motion that a copy of the First volume of the Proceedings be sent to the Zoological Society of London with a request for exchange, and that the transmission of the Proceedings to the Geological Society of London cease from this date.

APRIL 15TH, 1859.

Vice-President SMITH in the chair.

Prof. Gibbes exhibited specimens of *Thalia dealbata* and *Vaccinium myrtifolium* from John's Island, South Carolina Coast, South of Charleston. Also presented in the name of *Lieut. Fauntleroy* of U. S. Coast Survey, Schooner Varina; the Radius of a Cetacean, found on the Coast.

MAY 2ND, 1859.

Vice-President SMITH in the chair.

The Chairman exhibited specimen of *Solidago ulmifolia*, which had flowered on 30*th. of April.* The usual flowering time is the Autumn.

MAY 16TH, 1859.

Vice-President SMITH in the chair.

The Chairman exhibited a specimen of *Ilex dahoon* from Mount Pleasant, a somewhat rare plant, of which there is no specimen in Ravenel's Herbarium.

Prof. McCrady presented a specimen of *Opuntia frustulenta* found on the ramparts of Fort Moultrie, Sullivan's Island.

Prof. McCrady made also some remarks upon *Anthea flavidula* a new species of *Actinia*, of which there are now eight undescribed species known to him as belonging to Charleston Harbor besides *Zoanthus*.*

JUNE 1ST, 1859.

Vice-President W. WRAGG SMITH in the chair.

Contributions to the Library.

Die Temperatur von Emden. 1855. *From Dr. M. A. F. Prestel.*

Jahresberichte der Naturforschenden Gesellschafft in Emden für 1854–'55–'56–'57 ; Bände XL. XLI. XLII. XLIII.

Beiträge zür Kenntniss des Klimas von Östfriesland. Dr. Prestel, Kleine Schriften der Naturfor. Gesell. von Emden.

Die Gewitter des Jahres 1855, Prestel Naturf. Gesell. von Emden.

Catalogus Coleopterorum Europæ, herausgegeben vom Entomologischen Verein in Stettin 1858. 8vo. pamphlet. *Presented by Wm. Sharswood, Esq.*

Journal of the Geological Society of Dublin Vol. VIII. p. I.

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* The memoranda made of the specific characters of these species were destroyed with the books and papers of Prof. McCrady. in the sack of the city of Columbia, S. C. by Gen Sherman of the U. S. Army, February, 1865.

Proceedings of the Berwickshire Naturalist's Club. Vol. IV. No. 11.

Reply to the "Statement of the Trustees" of the Dudley Observatory, by Benj. Althorp Gould, in 1859. 8vo.

Bibliographia Librorum Entomologicorum in America Boreali editorum, Guil. Sharswood.

Contractiones Titulorum Operum citatorum in Bibliographia, Guil. Sharswood.

Proceedings of the Boston Society of Natural History, Vol. VII. Nos. 26 and 27. *From the Society.*

Proceedings of the Academy of Natural Sciences Philadelphia, April, 1859. *From the Society.*

Synopsis of the Genera of Gammaracea. James D. Dana. *Presented by Prof. L. R. Gibbes.*

Conspectus Crustaceorum. J. D. Dana. *Presented by Prof. Lewis R. Gibbes.*

JUNE 15TH, 1859.

Vice-President W. WRAGG SMITH in the chair.

A letter was recieved from Wm. Sharswood, Esq. requesting six copies of the last issue of the Society's Journal and one of the 3rd No. for distribution, also six copies of the Constitution. Ordered to be furnished.

Prof. McCrady made some remarks on *Liriopsis scutigera.* Also reported having found the embryo of a Ctenophorous Medusa (supposed to be *Beroe punctata,*) younger than any heretofore observed, being still surrounded with the transparent membrane or cell wall of the ovum, though already provided with ciliary blades near the sense-capsule, and revolving by their means within its prison. This shows that the strictly Ctenophoran type is assumed by the embryo before it is hatched from the egg, and there is no room left for doubt that the embryo passes directly from the polyp-stage into that of the Ctenophora without passing through the form of the Discophora.

Prof. McCrady also detailed some additional facts in regard to the train of *Physalia aurigera.**

* The records of these facts were destroyed by Gen. Sherman in Columbia, S. C.

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SMITHSONIAN INSTITUTION.

UNITED STATES NATIONAL MUSEUM.

P. B. MAR 30 1906

W. G. Mazÿck esq
Equitable Fire Insurance Co
Charleston, S. C.

Donates vol. II, Proc. Elliott Soc. of S. Carolina, to the library Nat. Mus.

This is an extremely rare work and contains papers by r. Ravenel, Manigault, McCrady L. Gibbes, &c. &c.

JULY 1ST, 1859.

Vice-President W. W. SMITH in the chair.

The Chairman exhibited the flower of *Aristolochia labiosa* from a garden in Charleston.

Contribution to the Collection.

Alcoholic specimens of a slug found in Pendleton, S. C. *Presented by Dr. Edmund Ravenel.*

Prof. McCrady stated that since the publication of his paper *on the Gymnophthalmata of Charleston Harbor* he had found on Gulf Weed in the Harbor the *Aglaophenia pelasgica* described in that work. He brought it to the attention of the Society because he had stated in the paper referred to, that though found on the Gulf Weed the *A. pelasgica* had not yet appeared on the specimens obtained in Charleston.*

Mr. W. W. Smith mentioned that he had found growing at Bacon's Bridge St. George's Colleton, a variety of *Anemone virginica* having white flowers, and of a larger size than the ordinary form of the species bears.†

JULY 15TH, 1859.

Vice-President W. W. SMITH in the chair.

Prof. Lewis R. Gibbes made a few remarks on a journey he had recently made in Virginia from Richmond to the Springs. He specially mentioned Salt Pond Mountain where Pursh collected some of his most valuable specimens of plants. This mountain has an elevation of 3000 ft. above the level of the Sea. The stage road runs over it at this elevation for about five miles. Here Pursh found *Parnassia asarifolia*, *Trautvetteria palmata*, and also *Boykinia aconitifolia* which he mistook for *Heucheria villosa*. All these were found again by Prof. Gibbes in the same locality, and besides them he found *Gualteria procumbens* and *Sedum ternatum*. Prof. Gibbes exhibited living specimens of the last named plant and of *Parnassia asarifolia* from Salt Pond Mountain, and observed that he was probably the first Botanist who had visited the locality since Pursh.

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* See Proceedings Elliott Society, Vol. I. p. 201.

† This seems to be the variety alluded to in Gray's Manual, as having larger, obtuse and perfectly white petals. W. W. S.

Prof. McCrady remarked that he had found our species of *Oculina* (hitherto referred to the *O. pallens* of EHRENBERG) at only two feet below water-mark on Sullivan's Island. It spreads at the base very much in the manner of *Astroitis.*

6TH ANNIVERSARY MEETING.

NOVEMBER 1ST, 1859.

The following Officers were elected for the ensuing year:

President.

LEWIS R. GIBBES.

Vice-Presidents.

W. WRAGG SMITH, WILLIAM HUME,
EDMUND RAVENEL.

Corresponding Secretary.

J. F. M. GEDDINGS.

Recording Secretary.

GEORGE E. TRESCOT.

Treasurer.

ROBERT HUME.

Curators.

JOHN MCCRADY,
WM. HUTSON FORD,
J. P. CHAZAL,
J. F. M GEDDINGS,
H. W. WRIGHT,
ROBERT HUME,
GEO. E. TRESCOT.

Contributions to the Library.

Proceedings of the American Philosophical Society of Philadelphia, Vol. VII. No. 61.

Proceedings of the Academy of Natural Sciences of Philadelphia, 1859. Vol. VII, pp. 177–192.

Letters acknowledging the reception of the Journal of this Society were also received from Wm. Sharswood, Esq.; the Academy of Sciences of St. Louis, Missouri; and the New York State Academy.

NOVEMBER 15TH, 1859.

Vice-President W. W. Smith in the chair.

Contributions to the Library.

Kaiserlich-Königlichen zoologisch-botanische Gesellschaft in Wien. Sitzungs-berichte für das Gesellschafts jahr 1858. Verhandlungen, Jahrgang 1858.

La Bourgogne—Revue Œnologique et Viticole, par C. Ladry, Prof. de Chimie à la Faculté des Sciences de Dijon.

Compte Rendu Annuel de l'observatoire physique centrale du St. Pétersbourg, année 1859.

Fest Bericht der Zehnjährigen Stiftungsfeier des Vereins Deutscher Ärzte in Paris. Dr. H. L. Medeing.

Novorum Actorum Academiæ Cæsareæ Leopoldino-Carolinæ Naturæ Curiosorum. Voluminis vicesimi-quarti, pars posterior cum tabulis XVII.

Ernst Engel, Die Baumvollen-Spinnerei in Königreich-Sachsen.

Neuste Schriften der Naturforschenden Gesellschaft in Danzig. 4 Band, 3 Heft.

Transactions of the Academy of Sciences of St. Louis, Mo., Vol. I, No. 2.

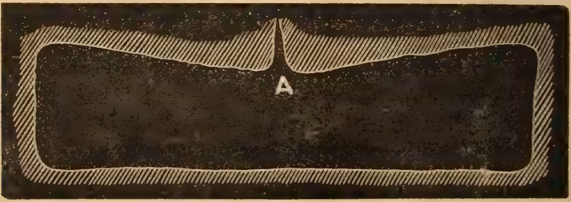
Contribution to the Collection.

One box of specimens from the Pacific Coast of America. *Presented by the California Society of Natural History.*

Published July 6th. 1870.

Prof. McCrady stated that in a recent visit to Tennessee he had visited some caves in the neighbourhood of Clarkesville, in the same region as that of the Mammoth Cave. One of these caves especially exhibited the process by which "*sinks*" are formed. This was evidenced at the very entrance which was at the bottom of a large sink and consisted of a small hole in the ground 2ft. by 18in. at its narrowest part. This passage conducted through about six feet of rock to the cieling of a large chamber, which he estimated at about 50ft. in height. Immediately below the narrow opening described above was a hill which had to be descended before reaching the floor of the cavern, and which he estimated at from 20 to 25 ft. in height.

The sink had been formed evidently by the breaking in of the roof of the cave and the hill beneath was simply the heap formed by the falling roof on the cavern floor. But it was singular that the Cave ended abruptly in this direction, so that in all probability the fallen mass was greater than sufficed merely to form the hillock and that it had actually filled up the cave in that direction. Further on, the floor of the cavern was covered by large angular masses of rocks thrown together in the wildest confusion, so that footing upon them in their slimy condition was really a laborious and dangerous work; especially when serious crevices had to be crossed. On looking upwards along the sidewalls of the cavern it was evident at a glance whence had come the fragments in the floor. They were evidently the remains of successive roofs of the cave which had given way one after another leaving their projectieg ledges still visible in horizontal lines along the cave wall. After traversing this chamber or rather this long gallery, the character of the cave changed, becoming narrow and low, and the cavity surrounded on all sides with clay, clay walls, clay roof, clay floor. Suddenly the whole cave proved to be shut up with clay except a narrow sinuous tunnel, admitting only one person at a time, and not much higher than the head. Through this he passed for about twenty paces when equally suddenly the clay barrier disappeared and a wide but low roofed room again opened before him. A few paces futher on the roof was of rock and so low that it could be reached with the candle in his hand. It was also so much forced downwards by the superincumbent mass above as to have been cracked in the direction of the length of the cave, so as to present nearly the following transverse section, exhibiting the breaking down of an upper floor or roof in actual progress at **A**. Beyond this as far as he went there were no signs of disturbance by the formation of sinks. The low and breaking roof described above was followed by a large high-roofed cavern with undisturbed stalagmites and stalactites, which in one case had formed a large column from the roof to the floor. On the right



of this cavern a large rift running longitudinally for a great part of the length of the chamber opened into another cave of unknown dimensions, whose floor seemed to be far below the level of that in which he stood judging by the distant hollow sound of an invisible stream falling over a precipice in the impenetrable darkness of the lateral cavern, and producing the most melancholy reverberations as it plunged into the pool below. The lateral rift above referred to, bristled with interdigitating lanceolate stalagmites and stalactites which presented nothing of that beautiful and sparkling appearance sometimes seen, but with their tawny hue and fanglike form, rather suggested the open jaws of some gigantic monster. Beyond, this last chamber was suddenly obstructed by a precipitous rock about 15ft. in height, the upper surface of which formed the floor of a cave at a greater elevation. Mr. McCrady went no further than this precipice on account of the lateness of the hour but he was told that at some distance the upper cave led to a very considerable subterranean stream.

Mr. McCrady thought it probable that there were not many caves in which so many evidences of the manner in which sinks were formed in a limestone country would be found collected together so that they could all be seen in the space of four hours. In the first place the cave was entered through a small orifice in the bottom of a sink, beneath which was a hillock probably formed by the debris of the fallen roof, at the same time that the abrupt termination of the cave in this direction seemed to indicate that this hillock was only a small fraction of the mass of earth which had fallen and which probably sufficed to close the cave in that direction. The long gallery covered with its large angular fragments of broken rock from the roof showed the process by which the gradual weakening of the roof was effected until at last it could no longer resist the weight of the soil above. And the low-roofed vault in which he found himself after passing the clay tunnel exhibited the roof in actual process of being broken through.

He said we have no known caves in the low country of South Carolina—but in some sections the sinks are numerous and often of considerable diameter. He had been told too by the planters that they frequently follow each other in lines, In the neighbourhood of Eutaw Springs they are quite frequent, and the stream from those springs after emerging and forming a large pond disappears under a neighbouring hill to emerge on the other side. The head-waters of the Cooper River also near the Wantoot Plantation, emerge from the ground as a bold stream, showing that this river must be a subterranean stream for a very considerable distance before it bursts into the light of day. These facts show that our low country is like the limestone country of Kentucky and North Tennessee, founded upon limestone strata tunnelled in every direction by a labyrinth of caves. well supplied with subterranean water courses, and the lines of sinks are indications of the directions taken by the cave-tunnels. This limestone formation in South Carolina can hardly be any other than the Eocene.

In the neighbourhood of Lake City, Florida, numerous sinks occur, which usually are filled with water having subterranean communication, and the lakes so formed are often of great depth. Mr McCrady had himself seen in that vicinity a dry sink in the midst of a pine forest so deep that a large yellow pine, (*Pinus australis,*) which had been overturned by the suddenness of its formation, lay with its roots at the edge of the sink and its top at the bottom. He could not say whether the Florida system of caves belonged to the Tertiary age, or to that vast develpment of coral formation which, according to Prof. Agassiz' view, has built up the whole peninsular of Florida, since the commencement of the present geological epoch; but he was inclined to attribute it to the Tertiary.

DECEMBER 1st, 1859.

Vice-President W. Wragg Smith in the chair.

Contributions to the Library.

Proceedings of the Academy of Natural Sciences, Philadelphia. Vol. VII, pp. 1–30.

Proceedings of the Boston Society of Natural History. Vol. VII, pp. 97–128.

A letter was read, from the Smithsonian Institution, asking for a copy of the Proceedings and Journal of the Elliott Society for Prof. Victor Carus. Granted.

Also a letter of thanks, from the New York State Library, for copies of the Proceedings and Journal of this Society.

A draft of a memorial to the Legislature of South Carolina, praying aid to the Society, was read and approved.

Mr. J. R. Mordecai presented to the Society a copy of a recipe of Dr. Milne Edwards for making a preserving liquid for animal tissues.

A letter of resignation from J. D. Aiken, Esq., was read and accepted.

DECEMBER 15TH, 1859.

VicePresident W. WRAGG SMITH in the chair.

Contributions to the Library.

Proceedings of the Academy of Natural Sciences, Philadelphia, Vol. VII. pp. 193–286, with colored plates.

Transactions of the American Philosophical Society. Art. XII. and XIII. *From Prof. Joseph Leidy.*

Bericht des Naturhistorischen Vereins in Augsberg. Nos. 8, 9, 10 and 11.

Siebenter Bericht der Oberhessichen Gesellschaft für Natur- und Heilkunde. Giessen, Jan., 1859.

Mémoires de l'Académie Impériale des Sciences, Arts et BellesLettres de Dijon. Tomes 5, 6 et 7, du 2me Série.

Geological Sketch of the Estuary and Fresh Water Deposit forming the Bad Lands of Judith River, with some remarks upon the surrounding formation. By F. V. Hayden, M. D. *From Prof. Joseph Leidy.*

Extinct Vertebrata from the Judith River and great Lignite Formations of Nebraska, by Joseph Leidy, M. D. *From the Author.*

Contributions to the Collection.

Specimens of Bone, collected in the caves of Tennessee by Prof. John McCrady. *Presented by Prof. McCrady.*

Specimen of *Clypeaster rosaceus* from Key West. *Presented by Prof. McCrady.*

JANUARY 2D, 1860.

President L. R. GIBBES in the chair.

Contributions to the Collection.

Specimens from the Palæozoic and Carboniferous Rocks of Tennessee. *Presented by Prof. John McCrady.*

JANUARY 16TH, 1860.

Vice-President W. W. SMITH in the chair.

Contributions to the Library.

Description of a Deformed, fragmentary Human Skull from an ancient quarry cave at Jerusalem, by J. Aitken Meigs, M. D. *From the Author.*

Proceedings of the Boston Society of Natural History, Vol. VII., pp. 129–160.

Proceedings of the Academy of Natural Sciences, Philadelphia, 1859, Vol. VII., pp. 287–326, with printed notice.

FEBRUARY 1ST, 1860.

Vice-President W. W. SMITH in the chair.

Contributions to the Library.

Proceedings of the Academy of Natural Sciences, Philadelphia, 1859, Vol. VII., pp. 327 to Finis.

A copy of the Mount Holly Mirror (Gazette) containing announcement of the formation of Burlington County Lyceum, New Jersey.

Catalogue of Recent Marine Shells from the Coast of South Carolina, by J. D. Kurtz. Portland, 1860.

Vice-President Smith read the following paper:

Autumn Coloring, Fall of the Leaf, and Winter Habit of Trees and Shrubs in the lower country of South Carolina.

BY WM. WRAGG SMITH.

> "And Autumn laying here and there
> A fiery finger on the leaves ;———"
>
> TENNYSON, IN MEMORIAM.

THE Winter of 1859 set in somewhat earlier than usual. There had been two severe black frosts, the first occurring as early as the 30th October, previously to the dates at which these notes were recorded. After this, the weather continued cold and dry for some time. Generally, in this section, the forests may be said to be in the plenitude of their autumnal glory from the middle unto the close of November.

These observations were made at about the distance of from 15 to 20 miles, in a Northwesterly direction from Charleston. Such trees and shrubs as grow or have been naturalized in the City and vicinity are subject to a somewhat milder temperature. The first date given is November 20th.

The Sweet Gum (*Liquidambar styraciflua*) exhibits a varied drapery of green, yellow and russet intermingled, passing finally into a deep crimson. Downing, in his "Landscape Gardening," describes it as "assuming in Autumn its gayest livery, being decked in colors almost too bright and vivid for foliage; forming one of the most brilliant objects of American scenery at that period of the year. When planted in the neighbourhood of our fine Maples, Ashes, and other trees remarkable for their autumnal coloring, the effect in a warm, dry Autumn, is almost magical." Others have compared its color to that of freshly-shed blood.

The leaves at this date are partly falling. The burrs are, at first, greenish-brown, soon becoming brown. From the 3d to the 10th December, the trees had become generally divested and bare of their leaves, and the burrs were now of a darker brown, appearing, except upon close inspection, black. By Christmas, the Gum trees present the most unsightly and gloomy aspects imaginable, shrouded in their long robes of moss, fit emblems, like the melancholy Cypresses, of stern and hoary Winter. Even then, however, in a few sheltered spots, the lower branches of some trees, and the young growth, retain a few unwithered leaves. Before this period, the burrs, with their long peduncles attached, have commenced to fall; but very slowly. They remain, for the most part, upon the tree, during the whole Winter, and even in the Spring it is not uncommon to see them intermingled with the flowers. The seeds, however, have been discharged in the Autumn or early Winter. The Cat birds (*Turdus felivox*) which arrive in numbers in Carolina about that time, are seen feeding on them: also the Robins (*Turdus migratorius*) attack them in the first instance, about the same time as they do the Holly and Gall-berries, before they make their appearance about the Pride of India and Wild Orange. And the Pine finches (*Fringilla Pinus*) make them their especial repast: they may now be seen hanging on awhile to the burrs, or passing nimbly from one to another.

The Dogwood, (*Cornus florida*), is now very conspicuous, and, with its spreading canopy of sombre red, flames amid the evergreens. Its bright red drupes, which have just lent their brilliancy to the Autumn landscape, have mostly disappeared; though in milder seasons they are seen sometimes as late as the middle of December. By that time the leaves have, for the most part, fallen: in very sheltered situations they are retained somewhat longer. A characteristic feature, which in Winter more epecially would attract the attention, is the appearance of dark brown, ovate or oblong excressences formed at or near the extremities of the twigs below the buds. They are woody, hollow, and at this time generally empty; but are the work of an insect, and occasionally a small green fly, or an orange-colored grub may be discovered. Another conspicuous feature is exhibited in the nascent involucres which crown the bare twigs. The naked tree in Winter is readily identified by these appearances; but Dogwood should be best known by its *bark*, which is *gnarly* or *rough*, cracked into little *whelks* and *hollows*, has a dark *hue* and is both *tonic* and *bitter*; while the tree itself, like the Bay, has a *bow*; and, to conclude with a doggrell,

> "Beneath the overarching shade
> Of the Dogwood's spreading *bough*,
> The *Chienne* Indians as is said
> Meet in Council or *pow-wow*."

The true origin, however, of the name is, perhaps, unknown to many who familiarly use it. Evelyn, in his "Forest Trees" informs us whence it was probably derived: "But it is very odd what Matthiolus affirms upon his own experience, that one who has been bitten of a mad dog, if in a year after he handle the wood of this tree till it grows warm, relapses into his former distemper."

Kalm, who visited America in 1748, states that in the vicinity of Philadelphia, the Cornelian Cherry had, on the 5th October, already a mixture of brown and pale leaves. The name of Cornelian Cherry was originally that of the European *C. sanguinea*. *C. masc.-virginiana* was that applied by the earlier botanists to our *C. florida*.

In bright contrast with the Dogwood, the Hickories (*Carya tomentosa*, and *C. glabra*, Torr.; *C. porcina*, Nutt., Mx., Ell.; to which may be added *C. amara*, Nutt., Mx., Ell., though not so frequently in company,—the common White-heart Hickory or Mocker nut, Pig-nut and Bitter-nut or Swamp Hickory, also commonly known as Pig-nut and confounded with *C. glabra*,) are of a vivid yellow. Their leaves have just commenced to fall: some are already becoming brown and crisp. When at the latter stage, a week or thereabouts later, those of the Pig-nut are distinguished from those of the first by their being of a lighter brown or greenish-red, the common Hickory likewise having the upper surface of a redder hue, and the lower somewhat hoary, with a stronger development of mid-rib and veins. By December 10th, they were denuded. Their nuts have fallen sometime since, those of the Pig-nut the soonest. Michaux observes that the sole feature by which the two former are distinguished from one another in winter after the leaves have fallen, is the character of the shoots of the preceding summer and of the buds, the former being brown in the Pig-nut, and less than half as large as those of the Mocker-nut, terminated by small oval buds. The buds of the latter are large, whitish-gray and very hard.* According to Kalm, Hickories in the vicinity of Philadelphia were yet entirely green on the 5th October.

The Tulip tree, (*Liriodendron tulipifera*,) had cast most of its leaves. It was not so conspicuous an object at this time as earlier, and as it is in other districts more favorable to its growth than ours is ; where it constitutes one of the richest features of Autumn scenery, its yellow, dazzling foliage, combined with that of the Hickory, (to both of which the comparison of "molten gold" has not inappropriately been applied,) contrasting with the fiery hues of Gum and Dogwood, of the red and scarlet Oaks. By the 20th Dec. it was quite destitute of leaves ; but might be readily recognized at a distance by its peculiar, upright and elongated cones, stark and pale against the sky, which remain on during the whole Winter. Later, towards the close, the smooth leaf-buds half an inch in length commence to appear, conical, on their terete pedicels, at the extremities of the purple-brown twigs. Kalm noted that the leaves were still entirely green on the 5th Oct. in the vicinity of Philadelphia.

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* Only comparatively: they are more of a tawny color. Those of the Bitter-nut are distinguished as being naked and of a fine yellow. The bark also of the Common Hickory is much the most rugged.

The Scarlet-flowering, Red, or Swamp Maple, *(Acer rubrum,)* and the Beech, *(Fagus sylvestris,)* unite their mellowing tints to moderate the more gorgeous hues of other contributors to the picture. The leaves of the Maple are now yellow with a slight admixture of red. They are commencing to fall rapidly, and the tree is bare by the 10th Dec. By the 20th it had commenced to form its red flower-buds which in the next month expand into the blossoms and scarlet samaras which are the first harbingers of Spring. When the leaves are retained longer they are of a bright crimson.

"———— nor unnoted pass
The Sycamore, capricious in attire,
Now green, now tawny, and ere Autumn yet
Has changed the woods in scarlet honours bright."
COWPER, TASK.

The Maple loves the swamp ; but the Beech is not unfrequently associated with it on the insular knolls or rising grounds. We are more accustomed to its presence, however, on the rich, level high-lands—

"The veteran Beech that on the plain
Collects at eve the playful train—".
WHARTON.

Its conspicuous masses of foliage, though of a subdued yellow, spreading low and far to the ground, were at this time mostly changed to a modest livery of russet-brown.

"Unloved this Beech will gather brown,
This Maple burn itself away."
TENNYSON, IN MEMORIAM.

A few leaves only were falling. By the middle of Dec. large trees have their crowns stripped in exposed localities, but generally they remain undenuded most of the Winter. Younger trees retain them the whole Winter. Even as far North as New Jersey, Kalm writes that, whether great or small, they always kept a considerable part of their leaves during the whole Winter, even till Spring. The greater trees kept the lowermost leaves. The mast has dropped

Published July, 1885.

some time. The beech-nuts, after having been fed upon consecutively by flocks of wild pigeons, at certain seasons or in certain portions of the country, and of grakles, by blue jays, &c., furnish at the same time food to the raccoon, opossum, and squirrel; and, in general, an abundance is left for the hog and deer.

The White Oak (*Quercus alba*) is distinguished by its almost scarlet leaves with a glaucous or violet tinge, producing an unique and agreable contrast with the verdure of the evergreens, and the more defined tints of other trees in the neighbourhood. They have scarcely commenced to fall. From the 3d to the 10th of Dec. they began to fall rapidly, and by the 20th the trees were nearly defoliated. Young trees retain them longer. The fact asserted by Michaux, that it is the only species of Oak which in the heart of Winter retains some dried leaves which do not drop until the flow of the sap, is not so obvious. This is much more the case with the Spanish Oak, and still more so with the Water Oak. Kalm, on the 12th Feb., between Raccoon and Philadelphia, noted that most of the young trees, which were not above a quarter of a yard in diameter, had the greatest part of their leaves still on them, but the old trees had lost most of theirs, except in some places where they had got new shoots. According to our observations large trees were entirely naked before February.

The Swamp Chestnut Oak, likewise called White Oak, (*Q. prinus,*) is red, much like the former, but with less of the violet cast. By the 20th Dec. they were bare of leaves, except, here and there, some of the younger growth.

The Post Oak, another of the White Oak kind, (*Q. obtusiloba,*) had its leaves brown, slightly reddish, and crisp. It was seldom seen of any considerable size along our route of observation, being mostly of small, shrubby growth. In these the leaves are retained during the entire Winter, giving a monotonous and dreary aspect to the barren tracts in which they abound. A few isolated large trees had, however, cast their leaves after Christmas. After the leaves have fallen, it may easily be distinguished from any other similar growth in company, by its whiter bark, and numerous branches, which rise rather low down on the trunk, forming wide angles with the secondary branches, and remarkable for their tendency to frequent crooks or elbows. The acorns of the White Oak, as well as those of the Water Oak, (*Q. aquatica,*) and a few others. are much more available as mast than those of the Live Oak, (*Q. virens,*) as they last much longer on the ground. Those of the latter soon rot after they have dropped, while those of the former last till Spring.

Intermingled here and there with the Post Oaks, though commonly, occupymore exclusively higher, dryer, and more sterile soil, is the Black Jack, (*Q. nigra,*) readily distinguishable by its black and rugged bark, and its large, wedge-shaped leaves, obscurely three-lobed at the summit and cordate at the base, coriaceous and glossy; at this time, and later, of a brown hue, paler and less reddish than those of the Post Oak. According to Michaux, they fall soon after the first frosts; but those trees of the size we refer to retain them until February or longer.

Another small Oak occupying similar tracts, and similar in aspect, except as to its differently shaped leaves, is the Scrub Oak, (*Q. Catesbæi.*) Its leaves are now reddish-brown. From a dull red, they become browner. Michaux says they fall during the course of a month after frost. Those noted by us had most of their leaves remaining considerably longer. Some had fallen before Christmas, and some of larger growth had shed them by the middle of January; but, in general, we have observed them to retain at least half during the Winter. It is somewhat difficult to distinguish this species from the Black Jack when the leaves have disappeared. The bark sometimes appears equally as black and rugged; and both are indifferently called Scrub Oak.

The Spanish Oak, (Q. *falcata.*) Leaves still green, turning yellowish, and just commencing to drop very sparingly. Trees of small growth, and shoots from the stocks which have been cut down, have them reddish-brown. Large trees retain their faded foliage a long time after Christmas, but their tops are generally nearly stripped. The leaves are, about this time, reddish-brown with a yellowish tint, which distinguishes them at a distance in the forest. The leading shoots exhibit smaller leaves of the normal shape, with the prolonged, falcate middle lobe, and rounded base, while the inferior, more matured, have them larger, of an obovate outline somewhat, with the lateral lobes short, more obtuse and spreading, and the middle, or terminal one, short, also the base more acute. This is their appearance, likewise, on young trees, and shoots from stumps.* These retain their leaves, which are larger, and much longer. The largest trees have cast nearly all by February; but those of mean size last until Spring. The variety *triloba*, of small growth, also retains its brown leaves during the Winter.

The Water Oak, (*Q. aquatica,*) had, in general, up to January, preserved its green, tinged here and there with dull red. Towards the end of January, a few larger trees had cast their leaves, others not entirely, but they were brown and withered, as were likewise those of the undergrowth pretty generally. Other small trees retained them partly green, red and brown. Michaux remarks that in Virginia, where the Winters are pretty severe, its leaves fall after the first frosts, whilst in South Carolina, Georgia and Florida on the sea-board, the cold is so little felt that they last two, even three years without being renewed.

The Willow Oak (*Q. Phellos,*) appeared with its leaves, for the most part, green, slightly yellowed, and not shedding. As late as the 20th Dec. they were still green and yellowish, and had not shed much. But by the 20th January, they were entirely bare. At the former date the leaves of the young growth were of a deep or dull red. Those of small trees of the Laurel Oak, commonly also called Water Oak, though it affects dryer situations than *Q. aquatica*, were also at that date green and red, and are retained during the Winter, being nearly perennial in large trees, and not shedding till in the Spring.

Prof. McCrady made some remarks in which he contended that the discovery by Prof. Agassiz, that *Millepora* and the *Favositidae* are Hydroid Polypi related to *Hydractinia*, only confirmed him in the view he had suggested of the relation of *Hydractinia* to the *Velellidae*.*

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* Catesby, whose description of our Oaks is pretty accurate, says, of the Red Oak, (which has been sometimes confounded with the Spanish Oak and which latter he meant, from the plate given,) "The leaves of this Oak retain no certain form, but sport into various shapes more than other oaks do."

Specimen copies of Prof. L. R. Gibbes's "Rules for the Accentuation of Names in Natural History," were received from the printers.

FEBRUARY 15TH, 1860.

Vice-President W. Wragg Smith in the Chair.

Prof. McCrady made a communication in review of Darwin's "Theory of the Origin of Species."

APRIL 2D, 1860.

President L. R. Gibbes in the Chair.

Contributions to the Library.

Proceedings of the Zoölogical Society of London, part 25, 1857; volume for 1858, complete: and parts 1 and 2 of volume for 1859.

Ein Gedenkblatt für Alexander von Humboldt, Moskau, 1859.

Notice of Fossils from the Permian Strata of Texas and New Mexico, by B. F. Shumard, M. D. *From the Author.*

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* Proceedings Elliott Society, Vol. I, p. 141.

Proceedings of the Boston Society of Natural History, Nos. 11 and 12, December, 1859.

Contributions to the Collection.

The President presented, in the name of *Major Edward Manigault,* a fossil mammalian vertebra and a fragment of fossilized wood, found at Pocotaligo, S. C., twenty feet below the surface.

Also, in the name of *Dr. Edmund Ravenel,* a living Annelide, of the group *Hirudineae,* brooding over its ova, found in St. Thomas's Parish, near Charleston, S. C.

PROF. McCRADY speaking of the Leech presented this evening, remarked that it was of a genus allied to the European *Clepsine,* which was known to have the same habit of brooding over its ova. In speaking of the habits of the *Hirudineæ,* he gave an instance which he himself had witnessed at Chester, S. C., of the mode in which the Leech procures the blood of small fishes. In the larger animals the Leech attaches itself to the cutaneous covering, but in this case, it apparently tried, by the touch of its suctorial disk, every part of the surface, until it discovered the cleft of the gill-covers, through which it immediately thrust its head, and, passing it down the gullet, fastened it upon the heart, thus showing a remarkable degree of instinct in directing its efforts immediately to the centre of the whole blood system, and the fish was speedily bled to death.

Application by letter was made by Mr. Chas. W. Polman, in behalf of Herr Bjorling, Librarian of the Royal Library of Sweden, for a copy of the Proceedings of the Society, Vol. I. Granted.

A copy of the Proceedings of the Society, Vol. I, was voted for Mr. H. W. Ravenel, Aiken, S. C.

APRIL 16TH, 1860.

President L. R. GIBBES in the Chair.

Contributions to the Library.

Koninglijke Akademie van Wetenschappen, Amsterdam, Verhandlungen, Zwende Deel, mit platten, 1859. *From the Academy.*

Verslagen en Mededeelingen, Vols. 8 and 9, 1858-9.

Ditto, Literary Department, Vol. 4.

Jahrboek, 1858. *From the Academy.*

Realschule zu Neisse. Neisse, 1859. *From Wm. Sharswood, Esq., Philadelphia.*

Proceedings of the Boston Society of Natural History, Vol. 7, pp. 193-224.

Prodromus Descriptionis Animalium Evertebratorum, &c., pars VIII. W. Stimpson. *From the Author.*

Notes on North American Crustacea, No. 1., W. Stimpson. *From the Author.*

A letter was read from the Köninglijke Akademie van Wetenschappen, Amsterdam, soliciting exchange. Agreed to.

Also a letter from the Smithsonian Institution, acknowledging the receipt of Nos. 1 and 2 of the Proceedings of the Society.

The Leech with ova presented at the last meeting was again exhibited by the President, showing the progress of incubation.

PROF. MCCRADY exhibited two living specimens, a male and a female, of a new species of *Cheirocephalus*, found in a pond on Charleston neck. He remarked that it was quite a distinct species from the *C. diaphanus* of Europe, being scarcely an inch in length, and the male being provided with more sinuous, and proportionately larger prehensile antennæ, which bore each at its extremity, several blunt spines. The present species had also the eleven pairs of branchial legs more nearly of equal length, not shortest at the mouth and longest at the abdomen as in *C. diaphanus*. Like the other species, its habitual position in swimming is with the ventral surface uppermost. He proposed to name it CHEIROCEPHALUS DIGITATUS.

Prof. McCrady remarked that this and a small species of *Cypris* found in the the same pond, must be very rapid in their development from the egg, or must be capable, like the *Rotatoria*, of being partially dessicated without suffering the loss of vitality. The pond in which they were found was only a rain pool formed in the woods near his residence. It had been quite dry for some time past, but, in a day or two after a heavy rain, the water was filled with these *Entomostraca*, and in that short space of time, the *Cheirocephalus* had acquired fully developed sexual organs.

The President mentioned that he had found a species of *Cheirocephalus* at Stone Mountain, Georgia, in the summer of 1849.

In regard to the young *Hirudineæ* exhibited this evening, Prof. McCrady stated that the bright yellow organs seen through their transparent bodies were the digestive cavity and its appendages, with their lining of peculiar cells. Two of these appendages, larger than the rest, were given off as diverticula directed posteriorly, one on each side of the median line, and irresistably reminded one of the two blind diverticula in the same situation in *Distomata* and similar organs in some Planarians. He had himself no doubt of the propriety of uniting the *Hirudineæ* and *Distomata* in one group.

Members Elected.

Julian Mitchell, Esq. Dr. P. Gervais Robinson.

MAY 1st, 1860.

Vice-President W. Wragg Smith in the Chair.

Contributions to the Library.

First Report of the Geological and Agricultural Survey of Texas, with an Address by B. F. Shumard, State Geologist.

Proceedings of the Academy of Natural Sciences of Philadelphia, January, 1860, pages 1-48.

Donations to the Collection.

Branch of *Juniperus Virginianus*, covered with a fungus, and Nest containing eggs of an unknown bird. *Presented by Prof. J. McCrady.*

The Leech was again exhibited with its young, showing the progress of their development.

Prof. McCrady read a Review of Darwin's work on the "Origin of Species."

The following communication from Dr. Edmund Ravenel, regarding the Leech presented by him in April, was read:

Hirudo ?

Found on a piece of stick in a ditch, in water, at the Grove, on 25th March, 1860. About two inches long and not quite an inch wide. A flat disk, with seven rows of minute but prominent tubercles, running from the head to the tail, the centre one being the most prominent, and the tubercles so near as to have the appearance of a nodulous ridge. The other rows are decided, but not so prominent. Between these rows the spaces are filled with minute tubercles, some a little larger than the others. At the head the disk projects, forming a flap, which has also many tubercles, but is without the lines of tubercles of the body, The whole body has transverse wrinkles, which as they approach the margins become more strongly marked with irregularly placed tubercles. The margins are very thin. The colour is uniform over the whole upper surface—a dull blue-black. In attempting to remove it from the stick to which it was attached, I raised up the tail and then discovered that the animal was spread over a mass of eggs. The eggs are about one-thirtieth of an inch in diameter, yellow and rather firm. They are arranged in rows, irregularly, forming quite a mass, the number I could not determine but there must be over 100.

I did not disturb the animal sufficiently to let me say with certainty that it is a Leech, this name is used only from its general appearance. In removing the tail from the stick, it does not show the disk of attachment as usual with the Leech. The head I did not lift from the stick, as every movement seems to distress the animal, from the exposure of the eggs.

Say has described *Hirudo parasitica*, I have not his description and cannot compare this with it.

The *parasitica* is said to have its young attached to an opening on its under surface, but nothing is said of eggs.

JUNE 15TH, 1860.

Vice-President W. WRAGG SMITH in the Chair.

Contributions to the Library.

Proceedings of the Academy of Natural Sciences of Philadelphia, 1860, pages 81--144.

Forty-Second Annual Report of the Trustees of the New York State Library.

Proceedings of the Boston Society of Natural History, March, 1860, pp. 225–256.

Linnean Society of London. Journal of the Proceedings of the Department of Zoölogy, Nos. 7–15; Department of Botany, Nos. 7–15, with Supplement No. 2;

Address of Thos. Bell, Esq., President; (two copies,) and
List of the Members, 1858–9. *From the Society.*

Letters were read from the Linnean Society of London, acknowledging the receipt of the Society's Proceedings, Vol. I, sheets 4–11, and from the Royal Library of Berlin, acknowledging the receipt of the Society's Journal, Vol. I, Articles 1 and 2, and of its Proceedings, Vol. I.

The Leech was again exhibited with its young, showing the further progress of their development.

A communication from Prof. J. McCrady on the Larva of Brachiopods, was read.*

AUGUST 1st, 1860.

Vice-President W. Wragg Smith in the Chair.

Contributions to the Library.

Mémoires de l'Académie Impériale des Sciences, Arts et Belles-Lettres de Dijon, 1858–9.

Proceedings of the Academy of Natural Sciences of Philadelphia. 1860, pages 145–284, with Biological Department, pages 1–8.

Der Zoologische Garten, Frankfurt a. M., Nos. 1–6.

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* See Note page 6.

Published Aug. 1865.

Proceedings of the Boston Society of Natural History, pages 257--288.

Prarie Farmer, New Series, Vol. VI, No. 1.

Proceedings of the American Philosophical Society, Vol. VII, No. 3, January--June, 1860.

Physicalisch-Medicinische Gesellschaft in Würzburg: Sitzungsberichte, 1859.

Compte Rendu Annuel.

Donations to the Collection.

Broken Ribs of Fossil Manatee, from the Eocene of So Ca..;
Single Tooth of *Oxyrhina Desori*, from the Tertiary of S. C,; and
Canine Teeth of *Ursus Americanus*, from Louisiana. *Presented by Dr. Edmund Ravenel.*

Specimens of *Octopus*, *Comatula*, *Loligopsis*, *Carinaria* and *Argonauta*, from the Mediterranean, were deposited in the Collection of the Society by Mr. Mordecai.

Prof. J. McCrady resigned the office of Keeper of the Cabinet of Specimens.

Mr. McCrady made a verbal communication on Darwin's "Theory of Development."

AUGUST 15TH, 1860.

Vice-President W. WRAGG SMITH in the Chair.

Books Received.

Proceedings of the Academy of Natural Sciences of Philadelphia, 1860, pages 285--324.

Check Lists of the Shells of North America, prepared for the Smithsonian Institution, by Lea, Carpenter, Stimpson, Prime and Binney.

Donations to the Collection.

Eggs of *Ophiosaurus ventralis*, from Beaufort, S. C. *Presented by Prof. L. R. Gibbes.*

Dr. J. F. M. Geddings mentioned that he had examined a specimen of *Ophiosaurus ventralis*, in which the tail, having been broken off, was undergoing reproduction. Instead of the vertebral column, there was a cartilaginous representation which was divided so as to indicate distinct vertebral elements. Whether this was really the result of a *bona fide* outgrowth, or only the remains of a mutilated vertebral column degraded by absorption, he could not, from the observation, undertake to say.

SEPTEMBER 1st, 1860.

Vice-President W. Wragg Smith in the Chair.

Contributions to the Library.

Proceedings of the Boston Society of Natural History, pages 289-320.

Physicalisch-Medicinische Gesellschaft in Würzburg: Naturwissenschaftlicher Zeitschrift, von H. Müller, A. Schenck, und R. Wagner.

Denkschriften der Königlich Baierische Botanische Gesellschaft zu Regensburg, 1859.

Ansprache gehalten an des Ersten Decennium der Kaiserlich-Königlichen Geologische Reichsanstalt in Wien, Nov., 1859.

OCTOBER 15TH, 1860.

Vice-President W. WRAGG SMITH in the Chair.

Contributions to the Library.

Transactions of the Academy of Science of St. Louis, Vol. I., No. 4, 1860.

Donations to the Collection.

Group of *Balani* attached to valve of *Pecten*, from the Miocene of New Kent Co., Virginia. *From Dr. F. Peyre Porcher.*

Dr. F. Peyre Porcher read a paper on the Similarity of the Flora of Powhatan Co., Virginia, with that of Fairfield District, S. C.*

The following paper was presented:

THE LIMESTONE SPRINGS OF ST. JOHN'S, BERKELEY, and their probable availability for increasing the quantity of Fresh Water in Cooper River.

BY EDMUND RAVENEL, M. D.

THE most remarkable Spring in this locality is at Woodboo Plantation, now Mr. John Mazyck's. At the foot of a hill, a deep excavation is seen, into which the Spring issues; the water is quite clear and the movement of the sand where the stream escapes can be distinctly seén, the depth at this spot being over thirty feet. This excavation is the commencement of a large Creek, supplied entirely by this Spring and a second one, about 200 yards south of it. The second spring is much the larger, it is near forty feet deep, and the ripple of the water is seen distinctly at the surface. From the quantity of water plants, although the water is quite clear, the bottom cannot be seen. This large Creek empties immediately into the Santee Canal and has at all times been sufficient to keep the portion of the Canal between "Coal Hill Lock" and Cooper River in a navigable condition, even in the great drought of 1818, and subsequent droughts, when above "Black Oak Lock" the Canal was dry for months together. At the Plantation next East of Woodboo, there is another Spring which has never been known to fail, very much smaller than that at Woodboo, but interesting from its origin in the marl, and from its having several openings along the slope of a slight elevation, communicating with each other by subterranean passages. The quantity of water is quite moderate. This empties into the Santee Canal also.

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* See Note page 6. I would rewrite the paper but, I regret to say, I have forgotten the special plants which were common to each section; the general resemblance was very great. F. P. P., July 30, 1885.

The next Plantation West of Woodboo is Wantoot, the Homestead of one branch of the Ravenel Family, here there is another copious spring, from which a large quantity of water issues, by a half dozen or more openings in an extensive basin at the foot of the hill upon which the venerable Mansion stands. The water here issues from the marl which is about two or three feet below the surface at this spot. This water passes South and is carried under the Santee Canal in a Brick Acqueduct, to be used on the Rice-fields of Wantoot Plantation.

I once observed a small spring near the shore of this basin, and with my Brother, dug away the sand and mud, down to the Limestone or marl, and found the water issuing rapidly from a small hole in the marl. I cut off a joint from my fishing cane and inserted in the opening, and was surprised to find the water rise to the top and there overflow. I cut longer pieces of the cane, destroying the divisions at the joints, and by securing them with the clay at their junction with the marl, the water was found to rise about six feet above the marl ; the opening in the marl then became too large to permit further experiments, and in a few days an opening of about 18 inches gave vent to a full stream of water. By attaching a rifle ball to a line, the sounding was about 14 or 15 feet deep, the passage sloping irregularly, so that a greater depth could not be reached ; by baiting the line large fish were frequently caught in these trials.

At most of the Plantations in this neighbourhood there are similar Springs, at Pooshee, at the Fountain Swamp, at Chelsea and many others, which have all apparently the same origin ; they all escape from streams in the marl, and are all slightly affected by the presence of Lime.

At Eutaw, the Spring in the battle-field near the Old Brick House, is a spring of the same character ; there is a sudden depression in the field, with water issuing rapidly from one side and sinking into the other. A few hundred yards North of this Spring, Eutaw Creek commences suddenly, at a depression, by the bursting out of a very large spring. At a short distance down the Creek, North, a second very large spring issues, known as the "Blue Spring," these together pour out a great quantity of water, which passes into Santee River.

In this neighbourhood there are other Springs of considerable size which empty into Santee River.

Now, what is the Origin of these Springs? While interested as a boy, with my experiments upon the spouting of water at Wantoot Spring, and taking large trout, bream and perch from the hole in the Limestone, the elderly gentlemen visiting at our house, attracted by my interest in the matter, expressed the opinion, which seemed general among them, that these springs were all supplied with water from Santee River, but how, no one ventured to explain.

In after years, when better acquainted with the structure of the country between these Springs and Santee River, this opinion of our friends was frequently in my mind, and when, upon a visit to Columbia, I saw at Granby the change of structure at the Falls, where the primitive rocks seemed connected with the newer formations, I was struck with the probable truth of this opinion. Since then the position of the newer formations has been better known and the "Limestone," at bluffs on the Santee, has been more carefully examined.

The Geological Explorations which have been more recently made, explain the possibility of water entering strata of sand, above the primitive rocks, below Granby on the River, and percolating through these strata.

The Marl has been lifted from the bed of the ocean in which it was deposited, and in this process has been cracked and fissured, and irregularly acted upon, so as to make its surface extremely uneven. Now, water, meeting with open fissures in this Marl, would rise into them, if below its original level, and follow them in their course, and wherever these fissures come to the surface, would there appear in the form of Springs. These subterranean streams in the Marl are well known to exist ; the "Caves" and "Limestone Sinks" throughout the Marl Region are evidence of the fact.

That the source of the water is high up the River is evident from the emptying of some of these Springs into the Santee again, as at Eutaw and that neighbourhood, while others open below the ridge separating the waters of the Santee from the head-waters of Cooper River. In the neighbourhood of Black Oak Lock, on the Santee Canal, these Springs are particularly abundant.

In seasons of great drought, Cooper River becomes salt to its source, and then the only fresh water which enters it in any quantity is from Biggin Swamp, which empties its main Creek into the Santee Canal, and there meets the water from Woodboo Spring, and escapes at the Wooden Lock, at the mouth of the Canal. Now, this water is chiefly supplied by the Springs issuing from the Eocene Marl.

Forty years ago, the Rice Lands on Cooper River were as certain as any lands in the State, and from their easy access from Charleston, their great productiveness, the fine roads about them, and the cultivated society of the proprietors, were the most desirable and valuable lands in the State. In times of extreme drought, the salt water would occasionally ascend, for a short time, to points above some of the Rice Plantations, but it was for so short a time and so rarely that until the great drought of 1818, it occasioned but little inconvenience. Since then, however, the salt river has been more and more frequent, a gradual and steady increase of the difficulty has gone on, the salt water has encroached and the supply of fresh water so diminished, that uncertainty has taken the place of certainty, and there is apprehension now with every crop, that if the season is not a very wet one, the irrigation may be imperfect, from a salt river, and a consequent failure, more or less, of the product.

This change in the supply of Fresh Water to Cooper River, has been concurrent with the increased culture of Cotton, and can most probably be explained by reference to the clearing up of cotton lands in the region of country between the swamps which lie at the head of the main River, and their necessary drainage for the culture of that crop. The best lands are found on the borders of the swamps. These swamps are the Heads of the River. While these lands were in a state of Nature, the rain water was detained by the grass and undergrowth and the debris of the forest, upon the surface, so as to sink deeply into the earth, while accumulating in sufficient quantity to run into and along depressions to reach the Swamps, and ultimately the Rivers, and then was a long time oozing out in depressions, ponds, branches, &c., keeping up a supply of water to the Swamps. The quantity being sufficient in Cooper River to keep down the salt water to a point below the junction of the Eastern Branch with the Main River. With the extension of the Cotton culture on the borders of the great Swamps, the drainage thus necessarily carried off the water from rains with great rapidity, the water runs off nearly as fast as it falls, the land. exposed to the evaporating influence of the sun, is quickly dried, the Swamps are soon enptied into the River, and much rain is necessary again to saturate the dry surface before it accumulates sufficiently to run. In this way, although the quantity of rain may not have been sensibly diminished by the destruction of the forests, we can readily understand the effect upon the supply of Fresh Water to the River.

If the views above stated are correct, the question arises, as to the possibility or probability of increasing the supply of Fresh Water to Cooper River by means of these subterranean streams from Santee River. Is it practicable by opening extensively, by removing the earth and Limestone around and about these Springs, to increase the quantity of water which issues?

As one of the probable means of meeting a serious difficulty, it may be worth the consideration of the parties interested.

Our Marls are all soft or of very moderate hardness, the fissures in them have been, in many instances, known to be hollowed out, by the action of water running through them, so that the roof has become too weak to support the weight of marl and earth above them, and have consequently broken in, forming the Limestone Sinks and Fountains so common in the Limestone Region. It is probable, therefore, that removal of obstructions to the free egress of the water at these Springs, by increasing the rush at the openings and the quantity escaping, would soon enlarge the channels through which it is passing, and thus increase considerably the supply to the River.

With the same view, it would be a good experiment for the Planters to combine and sink Artesian Wells into the Marl at various points, with the hope of bringing to the surface some of these hidden streams, which, in comparatively modern times, have formed the Limestone Sinks, so common in the country. One such stream as that at Woodboo, discovered at a point where it could be made available, would irrigate a thousand acres of Rice Land, which, by the increase of value, by being made certain, would pay for the experiments of the whole River.

The cost of Artesian Wells will now be known, from the determination of the City Government to sink another well in Charleston, under the direction of Maj. Welton. His extensive experience, his knowledge now of all the requirements, with the aid of a steam engine, will not only facilitate the operation as to time, but will reduce the cost immensely.

Vice-President Smith added a few remarks to his last communication on the Comparative Weights of different woods, and their loss of weight in drying.

7TH ANNIVERSARY MEETING.

NOVEMBER 1st, 1860.

The following Officers were elected for the ensuing year:

President.
LEWIS R. GIBBES.

Vice-Presidents.
W. W. SMITH,
WILLIAM HUME,
EDMUND RAVENEL.

Corresponding Secretary.
J. F. M. GEDDINGS.

Recording Secretary.
G. E. TRESCOT.

Treasurer.
ROB'T HUME.

Curators.
JOHN MCCRADY,
WM. HUTSON FORD,
J. P. CHAZAL,
J. F. M. GEDDINGS,
W. H. WRIGHT,
ROBERT HUME,
GEORGE E. TRESCOT.

Books Received.

Proceedings of the Academy of Natural Sciences of Philadelphia, 1860, pages 361--412.

DECEMBER 15TH, 1860.

Vice-President W. WRAGG SMITH in the Chair.

Contributions to the Library.

Proceedings of the Boston Society of Natural History, Vol. VII. pages 1--22.

Proceedings of the Academy of Natural Sciences of Philadelphia, 1860, pages 413--476.

Der Zoologische Garten, Frankfurt a. M., Register, and Nos. 7, 8, 9, 10, and 12. 1860.

List of Shells collected in the Grand River Valley, Michigan, by A. O. Currier. *From the Author.*

Donations to the Collection.

Several bottles containing Fish, Fish ova, Crustacea, Echinodermata, Cephalopoda, and dried specimens of Short-stemmed *Lepas*, all from Beaufort, S. C. *From Dr. Robert Gibbes.*

Large specimens of *Anodonta* sps ? *From Vice-President W. W. Smith.*

Mass of Coral found on the beach at Eding's Bay, S. C. *From Benj. Johnson, Esq.*

The following papers were read:

TELLINIDÆ OF SOUTH CAROLINA.

BY EDMUND RAVENEL, M. D.

THE following Species of the Genus TELLINA I have found on the shores of South Carolina:

1. Tellina constricta.

Solen constrictus, BRUG. 1792.
Psammobia Cayennensis, LAM. 1818, from Brug.

Published Sept. 1885.

Tellina intustriata, SAY, 1826.
Tellina intustriata, DEKAY.
Tellina constricta, PHILIPPI, 1843.
Tellina constricta, d'ORBIG., 1846.

Say's description, "*Tellina intustriata.*" "Shell subovate, angulated at the anterior base, transversely wrinkled, and within slightly striated longitudinally.

Shell white, immaculate, ventricose ; wrinkles distinct, and with obsolete, longitudinal striæ ; posterior slope near the hinge parallel to the base ; posterior end obtusely rounded ; anterior hinge slope rectilinear, oblique ; fold rather profound, extending from the beak, to the junction of the base with the anterior end ; base viewed from the disk of the right valve subrectilinear, but very much arcuated with the concavity of the Shell ; hinge teeth small, lateral teeth none ; within longitudinally obsoletely striated ; beak rather before the central.

Length one and three-fifths inch, nearly ; breadth two and one-tenth inches, nearly."

Mr. Say obtained it from Coast of East Florida, I dredged single valves in the Harbour of Charleston in 1834, and subsequently obtained it from Smithville, N. C. It was found at Beaufort, N. C. by Mr. Wm. Stimpson. It is occasionally found on our beaches, but is not common.

2. Tellina alternata.

Tellina alternata, SAY, 1822.
Tellina alternata, SOW., 1846.
Peronæoderma alternata, ADAMS, *Gen. Recent Shells*, and M. d'ORBIGNY adds
Tellina punicea of BORN, GMEL., LAM., SOW., 1846, and also
Donax Martinicensis, LAM.

Say's description. "Shell compressed, oblong, narrowed and angulated before. White ; numerous parallel, equal, equidistant, impressed, concentric lines, which on the anterior margin are alternately obsolete ; interstitial spaces flat ; within tinged with yellow, a callous line, which is sometimes obsolete, passes from behind the hinge to the inner margin of the posterior cicatrix ; anterior hinge tooth emarginate ; posterior lamellar tooth very near the cardinal teeth, so as to appear like a primary tooth, that of the right valve wanting ; anterior lamellar tooth at the extremity of the ligament ; anterior hinge slope declining in a somewhat concave line to an obliquely truncated tip.

Length one inch and one-fourth, width two inches and one-fifth, thickness two-fifths of an inch. Inhabits Coast of Georgia and East Florida. Rather a common shell, beautifully and regularly striated.

It varies in being destitute of the yellow colour within."

Mr. Say says, "it is probably allied to *T. punicea.* It is much more elongated than the latter, the striæ are far more distinct, and it is entirely and always destitute of the rose colored bands and lines, such as are represented in Born's figure of that shell. It cannot be the *T. angulosa* of Gmel. as that species is described to be sub-orbicular, and to have the lateral teeth remote, whereas the '*alternata*' has but one of lateral teeth remote."

It is a common shell upon the beaches of South Carolina, and is in Mr. Stimpson's list of shells found at Beaufort, N. C.

3. Tellina interrupta.

Tellina interrupta, Wood, 1815.
Tellina maculosa, Lam., 1818.
Tellina interrupta, d'Orbigny, *L'Isle de Cuba, Mollusques,* 1855.

I have found two perfect specimens of this shell upon the beach at Sullivan's Island.

4. Tellina flexuosa.

Tellina flexuosa, Say, June, 1822.
Tellina mirabilis, Philippi, 1841.
Tellina flexuosa, Sow., 1846.
Tellina flexuosa, d'Orbigny, *Mollus. L'Isle de Cuba,* 1855.

Say's description : "Shell sub-orbicular, white ; anterior margin longer than the posterior one, and less obtusely rounded ; beak placed behind the middle, not prominent ; surface obliquely sculptured with very regular parallel, impressed lines, which on the anterior margin are four or five times refracted and infracted alternately ; longitudinal striæ none ; transverse wrinkles minute.

Length nine-twentieths of an inch. Breadth rather more. Thickness one-fourth of an inch. Inhabits the Southern Coast.

The fold on the anterior margin is very slight, but perceptible and is rendered remarkable by the zig-zag course of the oblique striæ over it."

Not uncommon upon the beaches near Charleston, So. Ca. Very common in the Post-Pleiocene at Cainhoy, Wando River, So. Ca.

5. Tellina polita.

Tellina polita, Say, June, 1822.
Angulus polita, Adams, *Gen. Recent Shells.*

Say's description : "Shell transversely sub-triangular, minutely wrinkled concentrically, white, immaculate ; anterior margin rather shorter than the posterior one, the hinge slope declining in a very slightly arcuated line, to a sub-acute termination ; basal margin nearly rectilinear from behind the middle to the anterior termination ; a lateral tooth behind the primary teeth.

Length two-fifths of an inch. Breadth thirteen-twentieths of an inch. Inhabits the Southern Coast, not unfrequently on the beach of South Carolina and East Florida."

It is common at Sullivan's Island.

6. Tellina iris.

Tellina iris, SAY, June, 1822.

Say's description : "Shell very thin and fragile, pellucid, compressed, transversely oblong-suboval, iridescent, white, with generally a rosaceous disk and one or two anterior rays, with numerous minute concentric wrinkles, and minute, oblique, acutely impressed, equidistant striæ crossing them ; striæ abbreviated before and not attaining the anterior margin, which is narrowed and sub-acute ; basal edge rectilinear opposite to the beaks.

Length more than three-tenths of an inch. Breadth more than eleven-twentieths of an inch.

Inhabits the Southern Shores. A beautiful little species, very remarkable by the oblique course of the striæ. It is rather common."

7. Tellina mera.

Tellina mera, SAY, *Pl.* 64, *fig.* 2. BINN., *Ed. Say, p.* 228.

Say's description : "*Specific Character.* Ovate-orbicular, transversely striated, hinge anterior to the middle, bidentate with a lateral tooth in one valve.

Desc. Shell small, thin, white, not very convex, somewhat regularly striated transversely ; beaks forming a rather prominent angle ; anterior side with an obvious undulation, and rectilinear as far as double the length of the ligament ; at tip rounded ; ligament rufous ; posterior side nearly rectilinear half the distance from the beaks to the middle of the tip, which is regularly and obtusely rounded ; basal margin obtusely and regularly arcuated ; hinge with two primary teeth in each valve ; posterior tooth small and triangular ; anterior tooth thicker, obtuse, and with an impressed line on its summit ; a single prominent lateral triangular tooth in the left valve ; sinus of the palleal impression remarkably large, in its posterior curvature almost confluent with the tip of the muscular impression.

Obs. Inhabits Coast of South Carolina. Dr. Ravenel.

In a particular light it has a slight appearance of longitudinal lines."

I sent to Mr. Say a single specimen of this shell, the only one which I had then seen, the specimen was not returned to me ; it was probably a young shell and immature, the specimen now in my Cabinet is a thick strong shell ; white, opaque with two strongly marked lines of growth, in addition to the slight transverse striæ.

This is quite a rare shell, I have obtained only two specimens, both from the beach at Sullivan's Island. Prof. L. R. Gibbes has four specimens from New Jersey.

8. Tellina tenta.

Tellina tenta, SAY, *Pl.* 65, *fig.* 3. BINN., *Ed. Say, p.* 228.
Peronæa tenta, ADAMS, *Gen. Recent Shells.*

Say's description : "*Specific Character.* Rostrum curved to the left. No lateral teeth.

Desc. Shell transversely oblong-ovate, fragile, a little compressed, white, with a tinge of dull yellowish towards the umbones ; wrinkles of growth not very prominent, but more obvious on the anterior side ; beaks a little before the middle, not much elevated ; anterior side narrowed, curved to the left, at tip truncated, or obviously emarginate ; umbonial slope hardly elevated ; within with an obsolete appearance of radiating lines ; lateral teeth none ; cardinal teeth in the left valve prominent ; a tinge of dull yellowish on the disk as on the exterior.

Obs. Inhabits the Coast of South Carolina, Dr. Ravenel. The proportions of length and breadth is nearly that of *Tellina nitida*, POLI, but the beaks are rather more anterior. The anterior side is a little more obtuse than that of *T. pulchella*, LAM. and a little more curved to the left nearer the tip. It evidently resembles *T. depressa*, GMEL. but I cannot perceive any lateral tooth."

This shell is occasionally found on the beaches near Charleston but is quite rare.

9. Tellina decora.

Tellina decora, SAY, Feb'y, 1826.

Say's description : "Shell transversely sub-ovate, rosaceous, or white with rosaceous radii ; not much compressed, numerous minute, concentric wrinkles, and regular, oblique, equidistant lines crossing them ; anterior margin destitute of the oblique lines ; posterior lateral tooth of the left valve prominent, the others obsolete ; apex a little before the middle.

Length more than one-half an inch. Breadth seventeen-twentieths of an inch. The largest specimen brought by Mr. T. Peale from the Southern Coast of Florida, is one inch in breadth.

In the character of the oblique striæ this species is allied to *T. iris*, NOBIS, but it is amply distinguished by its much greater size, less compressed form, oblique striæ, by its color, &c."

This species is occasionally found upon the beaches near Charleston, So. Ca., but is quite rare. It is not uncommon on the Florida Shores.

10. Tellina brevifrons.

Tellina brevifrons, SAY, *Pl.* 64, *fig.* 1. BINN. *Ed. Say, p.* 227.

Say's description : "*Specific Character.* Ovate, white, tinged with yellowish ; anterior side very short.

Desc. Shell thin and fragile, not very convex, white, tinged particularly on the umbo, with pale dull fulvous ; with transverse slender striæ, and in a particular light, obsolete longitudinal striæ are visible ; beaks much anterior to the middle, forming an angle in consequence of the anterior and posterior hinge margins being rectilinear to a considerable distance, the latter parallel to the base ; anterior side short and abrupt, rounded at tip, and with a sub-marginal undulation ; posterior side more than as long again as the anterior, rounded at tip ; within much more deeply colored with fulvous ; cardinal teeth two in the left valve and one in the right valve, lateral teeth none.

Obs. Inhabits the Coast of South Carolina.

The outline of this shell corresponds with *T. donacina*, LIN. but is more convex, and not radiated with reddish. Dr. Ravenel informs me that it is very rare, he obtained but a single specimen, which he obligingly sent to me for examination. It also resembles *T. decora*, SAY, and may readily be mistaken for it, but is altogether destitute of oblique striæ and rosaceous radiations."

This shell is occasionally found upon our shores but is very rare.

11. Tellina omoia.

Tellina tenuis, SAY, figure without description. BINN. *Ed. Say*, 229, *Pl.* 64, *fig.* 3.

Shell oval-triangular ; beaks behind the centre, somewhat prominent ; anterior end, from the beaks to a point opposite to them on the basal margin, regularly rounded, the posterior portion of the basal margin straight to the tip ; posterior end narrowed, truncated, angulated ; hinge slope straight to the upper angle ; with a rather decided undulation from the beaks to the posterior tip.

Shell smooth, somewhat polished, with fine irregular concentric striæ, some of them stronger than others ; color dull white, the portion next the beaks darker than near the margin ; the right valve is rather flatter than the other, particularly so from the beak to the posterior tip ; with a slight depression on the side extending obliquely from the beak to the base, which gives the shell a slight twist when viewed either from the hinge, or basal margin ; within this depression there are some obsolete longitudinal rays.

Within, for about a third of the shell near the beaks, the surface is rough, and pale yellow, the rest is white, with irregular concentric lines, crossed by obscure longitudinal striæ, with two irregular flattened ribs running obliquely from the beaks to the basal margin about a quarter of an inch from the posterior tip.

Cardinal teeth small, lateral teeth none, a flat projection from the beaks, under the ligament takes the place of the posterior lateral teeth.

Greatest diameter a little more than an inch.

This shell has been in my Cabinet over thirty years, believing it to be new, I sent it to Mr. Say, remarking its general resemblance to robust specimens of "*T. tenuis*" of Europe. He returned the specimen without a name, stating that he had retained a drawing and description for further examination ; this figure was subsequently published, with the name "*T. tenuis*" attached to it, but no description, See BINN. *Ed. Say, page* 229.

As the shell is certainly distinct from *T. tenuis*, it is necessary to name it.

It is very rare, I have seen but the single specimen, which I found upon the beach at Sullivan's Island, So. Ca.

12. Tellina eupareia, n. sps.

Shell oblong-ovate ; beaks moderately prominent, behind the middle ; anterior side regularly rounded ; posterior narrowed, the point irregularly truncated, and much bent to the right ; posterior fold distinct on both valves ; white, polished, not compressed ; with close concentric striæ, crossed by very delicate obsolete lines, only observed with the glass.

Lateral teeth more robust than usual.

This is a very pretty shell, a little over an inch in its longest diameter, very rare. I found this single specimen at Sullivan's Island in 1835, without the animal, but perfect.

13. Tellina athroa, n. sps.

Shell ovate-triangular, dull white, without polish, the lines of growth marking it with concentric ridges ; beaks rather prominent, behind the middle ; anterior side broad, rounded ; posterior a little compressed, bent to the right, narrow ; the line from the beak to the base straight, the slightly truncated point being made irregular by the termination of the posterior projecting fold ; interior polished, with closely set obsolete rays ; lateral teeth prominent.

This I supposed to be a very rare shell, I have had a single valve from Sullivan's Island beach for many years, but Mr. Stimpson has recently dredged detached valves at Beaufort, No. Ca., where he says it is not uncommon ; he did not get a perfect specimen.

The general appearance is very like the figure of *Tellina Martinicensis* of d'ORBIG., but our shell is of three times its size, and is less bent and flatter in proportion.

14. Tellina plagia, n. sps.

Shell ovate-triangular, white, thin, diaphanous, polished, covered by obsolete lines of growth, crossed obliquely by distinct striæ; the oblique striæ cease at the posterior fold, and at this point the lines of growth become more distinct; beaks a little prominent, behind the centre; anterior end regularly rounded; posterior end narrowed, slightly truncated and angulated at the tip by the rather prominent posterior fold; slope rectilinear; primary teeth delicate; lateral teeth more prominent, and the anterior one the most so.

This is a very pretty little shell, a little over a half inch in its longest diameter; it is quite rare. Prof. L. R. Gibbes has kindly sent me two detached valves, both of the right side, which he obtained on the beach near Charleston, So. Ca.

RICE CULTURE IN SOUTH CAROLINA.

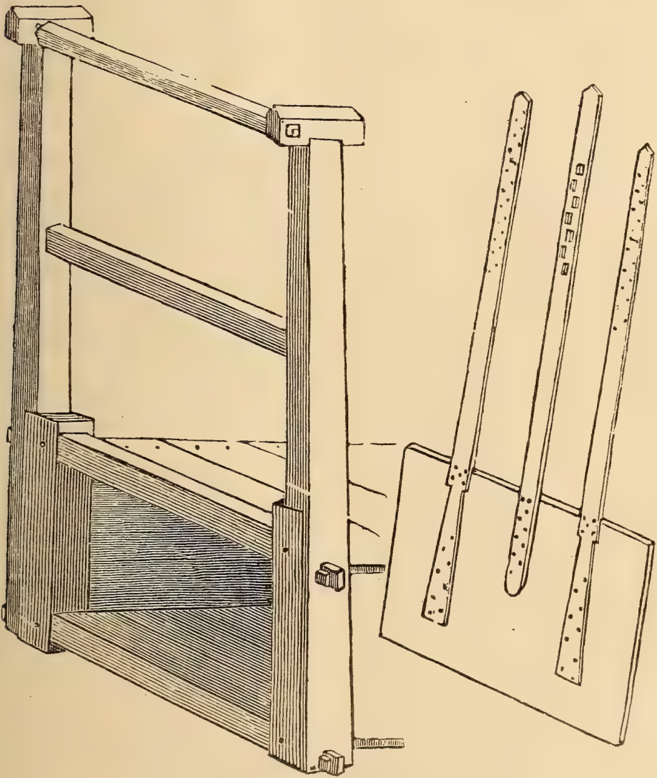
BY A. M. FORSTER, M. D.

The Cultivation of Rice in Carolina at the present day is conducted almost exclusively in the region of tide-water, upon lands which may be inundated or kept dry at the option of the cultivator. Those lands are most valuable for this staple which are above the reach of Salt water, and low enough down the river to have sufficient drainage at all seasons. Such lands lie generally between sixteen and thirty-six miles from the river mouth. Those higher up than thirty-six miles are too frequently inundated by freshets during the times of planting and harvest; and those lower down than sixteen miles often cannot obtain fresh water when the river is low.

The land to be taken into cultivation is first surrounded with an embankment sufficiently high to keep out the tides, and provided with a trunk or trunks for drainage: and is then cleared of its forest growth. The entire body first enclosed by bank is divided by smaller embankments into "squares" of fields of various sizes of five to thirty acres each, as a larger or smaller area can be found of nearly the same level, so as to ensure equal drainage and a uniform flow.

Besides the larger ditches which surround each square or field just inside the embankment (the earth from which forms the embankment,) there are smaller ones called *quarter drains*, running across the field, parallel to each other, at distances varying from seventy-five feet in new land (when the soil is porous,) to thirty-seven and a half feet in old, when the soil has become more compact by the more or less complete decay of the roots and other vegetable fibre. The larger ditches around the borders of the fields are generally about 5 feet deep and 4 or 5 feet wide: the quarter drains are 3 feet deep, by 18 inches wide. These latter are cut so near each other in order to effect, by thorough drainage, the aeration of the soil and the preparation of those constituents of the soil necessary to the good growth of the plant when the fields are inundated; a good "dry growth," during which there is thorough oxygenation of the soil, being followed by a fine "water growth" when the field is flowed.

For the purpose of regulating this flowing and draining, a *Trunk* is "buried" in each field, in a suitable part of the embankment next the river, opposite to, and in a line with, one of the large ditches. This trunk is set deep enough for its bottom to be a little below low-water mark, and is constructed in the following manner: two *Sides*, each 2 ft. wide, 4 inches thick, and 22 ft. long, are connected together, at a distance of 3 to 6 ft., by 2 in. plank running transversely, and forming the top and bottom of the trunk. A rectangular Culvert or Sluice is thus formed, of a capacity suited to the size of the field to be drained, from 6 to 12 square feet of area of transverse section. Fitting closely to the ends of this culvert are the *Faces*, which are formed, each, of four pieces



RICE-FIELD TRUNK.

(two transverse and two perpendicular) held together by tenons on the transverse running through the perpendiculars, and extending about 8 inches beyond, thus forming a rectangle of equal area to that of the mouth of the culvert. These Faces are secured to the body of the trunk by mortice and tenon. On the outside of the perpendiculars of these faces, the *Uprights* of the trunk are fastened by the extended tenons of the transverse pieces running through mortices in the uprights and secured by keys. These Uprights are 8 or 9 feet long, and upon the summit of each a cross piece is tenoned ; these support a transverse piece running from one to the other, as an axis from which is suspended the *Door* of the trunk. The *Doors,* which close the mouth of the trunk at either end, are made of 3 or 4 in. plank battened together, and so arranged as for either to swing off by its *Arms* when the water is flowing through the trunk from the opposite end, and to close against the entrance of water from its own side, and to be *hoisted* at the end from which it is desired the water should flow. The accompanying diagram will, perhaps, make this description intelligible.

In fields recently embanked, before the soil becomes compact by cultivation, or filled with grasses, the land is not turned preparatory to planting, but old lands are turned by the plough or hoe during the Winter.

Early in the Spring the plowed fields are harrowed, and the pulverization and levelling completed by the hoe. About the 20th March Planting is begun. The fields are trenched in drills or rows 13 or 14 in. apart, either by hoe or trenching plough, and the Rice is sowed by hand, at the rate of two and a half bushels per acre, and covered lightly. The water is now put on the field to the depth of about a foot on level fields, or deep enough to cover the highest portions in those of irregular surface, and is kept on until, upon examination, the Rice is found to be "pipped," that is, the germ shows itself as a small white point near the end of the grain. (The valves of the glume do not open or separate, but the germ forces its way through a small aperture which it makes, the sides of which press closely around the "sprout" to keep the water out.) This watering is called the "*Sprout Flow.*"

As soon as the Rice is pipped, the water is drawn off, and in a few days the young plant makes its appearance. When it is all above ground, and the row can be traced across the field by the eye, the water is again put on, and is retained for 4 to 6 days, as the weather may be warmer or cooler. When first put on, the water should cover the highest part of the field, in order to wet the hills thoroughly, and after 36 hours (three tides) it is "slacked down," so as just to cover the "average level" of the field. This is called the "*Point Flow.*" Its object is to push the Rice forward, to put it out of the way of the birds and of the early grasses, and to "stretch up" the lower part of the field, in order to bring the plant nearer to a general level.

The field is dried again ; and, as soon as the size of the Rice will allow, it is hoed with a 7 inch hoe. After an interval of about a fortnight, it is again hoed, more deeply than before, and in a day or two after, the water is again put on. This is the "*Long Water,*" and is continued from 12 to 30 days, and then the field is dried the third time. The same overtopping for two or three tides is practised in this as in the Point Flow, before the water is "slacked down" to suit the general level of the field. As the Rice grows during this Flow the water is raised gradually until all parts of the field are covered. Its object is to destroy a crop of grass and to hasten the growth of the plant, especially in the lower parts of the field, that, by bringing it all more nearly to a level, it may be watered to more advantage in the next flow.

Sufficient time having been allowed for the Rice to put out new roots *deeply*, in place of those superficial ones which supported the plant during the flow, it is again hoed, now with a 5 in. hoe, and all grass is carefully picked out of the Rice-row. In the earlier plantings, a fourth hoeing is given 10 or 15 days after the third. And now the final flow or "*Lay-by Water*" is put on. This is put on deep enough to cover the highest parts of the field if the plant in the lower parts is sufficiently tall, and it is gradually raised as the Rice grows, until it stands half-way up the stalk of the full grown plant. This Flow is continued until Harvest, the water being changed once or twice a week, *at night*.

As the planting season extends through a space of 6 or 8 weeks, in the later planted Rice there must necessarily be a modification of the watering, more water and less dry growth being given in proportion to the lateness of the planting.

The above is a mere outline of the mode of cultivating this staple. There are many details which it is unnecessary to mention, and many deviations from, and modifications of the process described; as, first, in the "Open Trench" system of planting. In this, the Rice, before being sown, is "clayed," that is, has a coating of clay given to each grain, by rubbing the Rice in water in which clay is suspended; and it is flowed without being covered with earth. (Without this preparation, the grain would float when the water is put on, being buoyed up by a thin stratum of air immediately in contact with the chaff, which the hairy coating of the chaff prevents the water from displacing.) When Rice is planted "open trench," the Sprout Flow is kept on much longer than when covered—say from 14 to 21 days, according to the temperature of the season. The after-treatment may be the same as in covered Rice. Its advantages are the saving of the labor of covering, and, generally, of one hoeing. Another modification is to make the Point Flow from 12 to 20 days instead of 4 or 5. This is to save labor by destroying the early crop of grass (particularly the Water Crab, *Ceresia fluitans*,) by entire submergence. Another method is to give the Rice no water after a short Point until it has been several times hoed, and then to give it the Lay-by Flow early. This plan is particularly good when the stand is thin, as, during the long dry growth, the plant branches or "tillers" freely, but it requires the free use of the hoe. Another plan is to continue the water from the Point Flow to the Harvest. In this method of culture, the water is "slacked down," and the fields "dragged through" with the hoe, and the grass picked out by hand.

There are some other modifications practised, each Cultivator having some fancy of his own, but the aim of all methods is to destroy grasses and to hasten the growth of the Rice.

About the last week in August or the first in September, the earlier Rice is ready for the sickle. A field is considered ripe for cutting when the grains are all hard except three or four of the lowermost on the panicle or head. The water is drawn off, and the Hands cut down with the Reap-hook as much as they can bind into sheaves and carry into the barn-yard during the latter half of the following day. During the forenoon of every day they cut down ; and during the afternoon they tie up and carry to the Barn-yard that which has been drying on the stubble since the day before. In the Barn-yard the Rice is put up in Ricks, generally of 22 feet length, by 8 feet breadth, and built up 12 or 15 feet high, of such shape as to turn the rain and keep the grain dry ; and in this condition it remains until threshed either by machinery or by flail. The portion intended for seed is never threshed by machinery, as by this process many of the grains have the "chaff cracked" (the glumes partially separated) so as to admit the water when planted, and this invariably rots the grain.

The Product of Rice Lands in Carolina varies from 30 to 75 bushels per acre ; and the quality of the grain is better in the N.E. part of the State than farther South.

One of the worst evils with which the Cultivator of Rice has to contend is Volunteer Rice. This is not a distinct species, but only a variety, produced in this way : During Harvest some grains are unavoidably broken off and left in the field, many of them pressed down into the earth by the feet of the Harvesters. Immediately after Harvest the fields are flowed for the purpose of sprouting these. Most of those near the surface, in the earlier harvested fields, germinate, and are destroyed by the first frost, but such as are too deep in the earth to germinate, or for the birds and ducks to find during the Winter, remain sound until brought near the surface in turning the land, and they spring up with the Rice sown for the crop, and grow with it. But its Winter exposure has changed its character : it ripens earlier ; and when reaped with the crop Rice, the grain so easily falls from the foot-stalk, that much of it is left in the field to increase the evil the next season. The product of this first year volunteer has these peculiarities augmented every season, so that by the third or fourth year, the head of Volunteer Rice has ripened and dropped all its grains by the time of Harvest, and half the sheaves carried to the Barn-yard may be "nothing but straw." Nor does the evil end here. The Volunteer grains which reach the mill require to be pounded longer than the Gold-Seed, because the Palea which forms the inner pellicle of the grain, is much more adherent, as well as much more apparent, having changed its straw-color (or nearly white) of the Gold-Seed, to a decided red, and this longer pounding impairs the quality of the whole.

The Grasses most troublesome to the Rice crop are the following :

Water Crab, (*Ceresia fluitans*,)
Goose Grass,
Shank Grass, (*Panicum crusgalli*,)
Shiny Grass or Flaxseed, (*Rhynchospora longirostris*,)
Rice-Cousin or Cat-tail, (*Leersia oryzoides*,)
Bull Grass or Crowfoot, (*Paspalum distichum*,)
Savannah Grass, (*Aulaxanthus ciliatus*, Ell., or *Panicum ignoratum*.)

Most of these grasses will grow in the water as well as the Rice will, but most of them may be killed if overtopped early enough, when the height of the Rice above the grass will allow it, as in the long Point, or when cut by the hoe and covered by the Long Water. When grown larger all that cannot be destroyed by the hoe must pe picked out by hand.

Rice is rarely attacked by the vegetable parasites, such as Rust or Smut.

Its enemies belonging to the animal kingdom are, the Water Weavil, which attacks the planted grain while it is in the "white sprout," eating the germ when it has just put forth ; the Chinch Bug, which, like the Aphis, sucks its sap when young and during the dry growth ; the Maggot, attacking its roots when the Rice has been some time flowed without frequent change of water ; the Grub, when it has been long dry ; the Caterpillar, very rarely, and only eating the blade.

The Rice-birds, which visit the fields in their migration Southwards and destroy thousands of bushels when the Rice is "in milk," and again on their way Northward in May, when, with the Dove, the Redwing, the Grosbeak, the Sparrow, the Teal, and the Summer Duck, they injure the stand by pulling up the planted grain.

To these remarks on the Cultivation of Rice, I will append a few observations on the subject of a defect in the Rice grain too frequently occuring, which impairs the beauty of the prepared article, and greatly lessens its value in the market. I refer to what is called " 'Chalk' in Rice," and the better to understand the nature of this affection, and thereby, if possible, to arrive at the cause, let us examine the whole process of the growth and development of the grain. The Rice having formed, during the month of June, several "root-joints," as they are termed, sends up early in July a "stalk-joint," and soon afterwards another, both of which elongate very greatly after their formation. The Rice then commences to "belly" or "barrel," that is, the panicle or head is formed above the second stem-joint, and, with the culm bearing it, closely invested with the sheaths of the upper leaves, gradually elongates, until, as if from the mouth of a cylinder, it makes its appearance, or "shoots."

The Rice, at this time, sends out *roots* from its upper or stem-joints, which never, (or very rarely) reach the earth, but ramify *abundantly in the water*, seeming to be intended to gather *nutriment only from the water*. When the Rice first shoots, and even before the panicle has emerged from its sheath, every grain, or rather every pair of glumes, is closed so as not to admit water. They continue thus hermetically sealed, until the whole head has shown itself, and feels the influence of the sun. The glumes then separate a little way and allow the anthers to fall out and hang by their long filaments until impregnation is effected. The pistils do not show themselves outside the valves of the glume. As soon as fructification has taken place, the anthers fall off, and the valves of the glume again cohere so closely as to be impervious to water, even should the plant be overtopped by a freshet.

The Palea is then prolonged, in a thread-like form, along what is termed the "*back of the grain,*" until it reaches the end of the cavity of the chaff. The long slender sack thus formed then commences to swell out with "milk," *increasing* gradually TOWARDS *the "belly" of the grain,* until the chaff is entirely filled with the sack (the Palea) enclosing the milk. The process of hardening now commences. This also *begins,* as the filling did, at *the back of the grain,* and *proceeds* regularly *toward the belly,* the middle of this portion being the last point of the grain to become hard. When this process is complete, the whole grain is opaque and of a chalky white. The process of becoming "flinty" or semi-translucent is now commenced, and this also at the same point as the previous change began, and it is *completed, should the grain reach perfection,* at the *central point* of the *belly,* where the filling and the hardening processes had previously been completed. But often, from some unknown cause, this change from opacity to semi-translucency is arrested when short of completion, and then an opaque white spot, which Planters call "Chalk," remains; the centre of this chalk spot, whatever be its size, always being the centre of the belly of the Rice grain. "Chalk in Rice," therefore, is an arrest of development and not a disease.

This arrest must owe its cause to some maltreatment of the Rice after it fills. Now as nothing is done to the plant after this time, except to change the water and to pick out the "Spade-Grass," it is probable that both these operations are concerned in producing this defect, by destroying (which they must of necessity do more or less,) these delicate rootlets specially provided for the perfecting of this change in the grain, and thus arresting the process by want of nutrition.

Commenting upon this paper, Vice-President Smith stated that the "long flow" is also called the "joint flow," and its object is to make the Rice plant "joint."

Vice-President Smith exhibited specimens of the Nest of the Larva of the Elder Borer, made of leaves cylindrically put together in the pith colon of the Elder, and read a paper "On the Larva of the Elder Borer, *Desmacerus palliatus.*"*

Prof. L. R. Gibbes read a "List of Addenda to the Botany of Edings' Bay, S. C.,† by Benjamin Johnson.*

Prof. McCrady reported the publication of Article 3, part 1, of the Society's Journal.

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* See Note, p. 6.

† See Proceedings Elliott Society, Vol. I, p, 241.

In consequence of the War the Meetings of the Society were suspended from December 15, 1860, to February 14, 1866.

FEBRUARY 14TH, 1866.

President L. R. Gibbes in the Chair.

On motion, the Chairman, being the only existing member of the Standing Committee, was requested to fill the vacant offices of the Society.

The following appointments were made, subject to confirmation by the Society at its next meeting:

Vice-Pesidents.

W. W. SMITH,
WILLIAM HUME,
EDMUND RAVENEL.

Corresponding Secretary.

J. F. M. GEDDINGS.

Recording Secretary.

G. E. TRESCOT.

Treasurer.

ROB'T HUME.

Curators.

J. F. M. Geddings,
John McCrady,
Wm. Hutson Ford,
J. P. Chazal,
George E. Trescot.

MARCH 1st, 1866.

President L. R. Gibbes in the Chair.

The appointments made, at the last meeting, to fill the vacant offices of the Society, were confirmed.

Prof. McCrady made a verbal communication on a Brachiopod Larva.

MARCH 15th, 1866.

The President in the Chair.

Dr. W. H. Ford made an oral communication on the Antagonism between Catarrhal Fever and Yellow Fever.

Members Elected.

Prof. F. S. Holmes, Dr. N. A. Pratt,
Joseph Manigault, Wm. G. Mazyck.

13th ANNIVERSARY MEETING.

NOVEMBER 1st, 1866.

The President in the Chair.

The Chairman read the following

REPORT OF THE STANDING COMMITTEE :

The Standing Committee, according to our By-Laws, have general supervision of the financial and other concerns of the Society, and it is the duty of the Chairman of that Committee to make an annual Report thereon. There have however been no meetings of the Committee during the past year, in consequence of the absence of most of the members of the Committee of Curators, and also of several of the Officers ; therefore the President, acting as Chairman of the Standing Committee, begs leave to offer the following Report :

After a long interruption of four years, the Society resumed, on the 1st Feb., 1866, its accustomed meetings, and has continued to hold them with tolerable regularity, once a month at least. Though no written communications on scientific subjects have been received, yet the few members, through whom the Society now manifests its vitality, exhibit such an interest in its existence and welfare, as to induce the hope that the time may come when the scientific activity of the Society will enable it to equal, nay to surpass, its former efforts.

The Treasurer of the Society, and his agent, left the City many months since and are still both absent. The latter has however transmitted to the President the books of his office, consisting of a Cash Book, a Ledger, and an incomplete Arrear List ; no vouchers however accompany them, but may be sent to us at some future time. These books are ready for delivery to the gentleman whom you will choose to-night for your Treasurer. The Cash Book shews a Balance of $ 143.00 which had been deposited in 1863, by the agent of the Treasurer, in the Palmetto Savings Institution ; this Institution has suffered the fate of so many of our Banks, and it is yet uncertain what portion of this deposit we shall be able to recover.

In Dec., 1859, the Society received from the Legislature of this State a donation of $ 500.00 which was paid on the 11th Feb., 1860, by the State Treasurer to the President, and by him expended as shewn in the following Statement, which can be verified by vouchers in his possession.

Expenditure of Legislative Donation to Elliott Society.

1860. Apr. 14,	Paid	Walker & Evans, printing Arts. 1 and 2 of Journal, 100 pages, . . .	$ 285.00
"	"	Walker & Evans, printing Article on Accentuation, 13 pages, . . .	48.00
July 20,	"	H. Francis, Cabinet, Case No. 2, . .	25.00
Oct. 4,	"	G. J. Kraft, (N.Y.) 7 gross pasteboard trays, $ 11.00, Freight, 1.60, . .	12.60
24,	"	W.P.Russell, sliding sashes for Case No. 2,	21.60
Nov. 5,	"	Moses King, for completing Case No. 2, .	11.80
1861. Mar. 30,	"	Evans & Cogswell, printing Article 3 of Journal, 14 pages, . . .	74.00
		Balance, . .	22.00
			$ 500.00

Published Nov., 1885.

There remained therefore in 1861, a Balance of $ 22 unexpended. In May of the present year, 1866, three boxes were received by Express from the Smithsonian Institution, Washington, consigned to the Corresponding Secretary of the Elliott Society. For the transportation of these boxes the President paid $ 22.05, and thus at once cancelled his indebtedness to the Society. On examination, one parcel was found to be addressed to Prof. Holmes, who paid $3 as his share of cost of transportation. Three other parcels were addressed to the Charleston Library Society, the Library of the South Carolina College, and the South Carolina Historical Society ; for each of these $ 2.50 was paid by the parties to whom they were respectively addressed. These sums have been collected by the Presdent, and his present indebtedness to the Society is therefore $ 10.45.

The Books received from various Foreign Societies with whom we are in correspondence, and transmitted by the Smithsonian Institution, as just mentioned, constitute a valuable addition to our Library, but the President has not yet had leisure to examine into the present condition of the Library, nor that of the Cabinet, and can therefore offer no Report thereon.

All of which is respectfully submitted and signed,

LEWIS R. GIBBES, *President*,
Acting Chairman Standing Committee.

Charleston, 1 Nov., 1866.

The following Officers were elected for the ensuing year :

President.

LEWIS R. GIBBES.

Vice-Presidents.

F. S. HOLMES,
L. A. FRAMPTON,
Rt. Rev. P. N. LYNCH,
EDMUND RAVENEL, Sr.

Corresponding Secretary.

J. F. M. GEDDINGS.

Recording Secretary.

G. E. TRESCOT.

Treasurer.

WM. G. MAZYCK.

Curators.

J. F. M. Geddings,
Wm. Hutson Ford,
John McCrady,
J. P. Chazal,

G. E. Manigault,	Wm. G. Mazyck,
P. G. Robinson,	George E. Trescot.

NOVEMBER 15th, 1866.

The President in the Chair.

A letter of resignation from Henry E. Young, Esq., was read and accepted.

Member Elected.

Dr. F. L. Parker.

JUNE 15th, 1867.

The President in the Chair.

Books Received.

Kongelige Norske Universitet i Christiania: Mærker efter en Istid i Omignen af Hardangerfjorden, af S. A. Sexe;

Veiviser ved geologische Excursioner i Christiania Omegn, af Sector Theodor Kjerulf;

Udsig over de væsentligste Forbedrinzer ved Jerntilvirkningen i de Seneste Decennier, af Rik. F. Stalsberg; and

Entomologische Undersogetser i Aarene 1864 og 1865, af H. Siebke.

Naturwissenschaftlicher Verein zū Bremen: Abhandlungen, Band I, Heft 1, vom Nov., 1864, bis März, 1866.

Naturforschende Gesellschaft, Emden: Jahrsbericht, 1865, von Hermann Meier;

Die Regenverhältnisse des Königreichs Hannover, von Dr. M. A. F. Prestel;

Festschrift herausgegeben in Verauslassung der Jubelfeier ihres 50 Jährigen Bestehens am 19ten December, 1864, von Hermann Meier;

Das wahre Gesätz der Planchen Entfernungen, von Prof. Gust. Heinrichs;

Prestelia, von Dr. C. H. Schultz-Bipontinus; and

Beobachtungen zu Nesserland, von W. F. Barghoorn.

Société des Sciences Naturelles de Strassbourg: Mémoires, Tome VI, Livraison 1.

Deutsche Ornithologische Gesellschaft: Berichte über die XIV versammlung gehalten im "Waldkator," zu Halberstadt und Braunschweig, September 29 bis October 2, 1862.

Der Zoologische Garten, 1866.

Zoologisch-Mineralogischen Verein in Regensburg: Correspondenz-blatt, 1866.

Zoological Society of London: Proceedings, and Report of the Council, 1865.

Royal Society of London: Proceedings, Vol. XIV, Nos 78 and 79, and Vol. XV, Nos. 80--86.

Kaiserliche Akademie der Wissenschaften, Wien: Math.-Naturw. Classe, Sitzungsberichte, Band 52, I Abt., 1865, Nos. 4--5, Band 53, I und II Abt., 1866; Band 54, I Abt., No. 1, II Abt., Nos. 1--4.

K. K. Zool.-Botan. Gesellschaft in Wien: Verhandlungen, Band XV.

Würzberger Naturwissenschaftliche Zietschrift von F. Sandberger und A. Schenk, Band VI., Heft 2.

Albany Institute: Transactions.

American Philosophical Society: Proceedings, Vol. X., No. 76.

U. S. Sanitary Commission Documents, 3 vols.

J. Gillies, Astronomical Observations, &c.

OCTOBER 15TH, 1867.

The President in the Chair.

Books Received.

U. S. Naval Observatory: Astronomical and Meteorological Observations, 1851--2, and

Zeitschrift für präktische Heilkunde, Wien, 1861. *Presented by Dr. Happoldt.*

Smithsonian Institution: Directions for Collecting, Preserving, and Transporting Specimens of Natural History, 6 copies. *From Prof. Gibbes.*

14TH ANNIVERSARY MEETING.

NOVEMBER 1ST, 1867.

The President in the Chair.

Books Received.

Royal Society of London: Proceedings, Vol. XV., Nos. 87--94.

American Philosophical Society: Proceedings, Vol. X., No. 77.

On motion of Prof. McCrady, the President was requested to call a Special Meeting of the Society on the 20th inst., for the purpose of changing Article I. of the Constitution.

The present Officers were re-elected.

NOVEMBER 20TH, 1867.

Special Meeting held under resolution adopted Nov. 1st.

The President in the Chair.

The Chairman stated that the object with which this meeting was called, was to change the name of the Society so as to include other departments of Science than Natural History, a measure which it was hoped would increase its usefulness.

On motion of Prof. McCrady, the Society resolved itself into Convention and Prof. Gibbes was requested to preside.

Several names having been suggested, it was decided by ballot that the Society should hereafter be known as the

ELLIOTT SOCIETY OF SCIENCE AND ART.

DECEMBER 12TH, 1867.

The President in the Chair.

The minutes of the Convention of Nov. 20, were read and confirmed.

Prof. McCrady requested permission to suspend the circulation of Art. 3, Vol. I. of the Society's Journal. Granted.

APRIL 9TH, 1868.

W. WRAGG SMITH, Esq. in the Chair.

Books Received.

Kongelige Norske Universitet, Christiania: Théobald Bœck, Aperçu des ouvrages et traités des lois, ordonnonces, décrets, &c., concernant la pêche en Norvege;

Adolph Strucker, Das Chemische Laboratorium der Universität Christiania;

G. O. Sars, Beretning om in i Somerrein 1865, foretagen Zoologiske Reise ved Kjesterne af Christiania;

G. O. Sars, Cladocera ctenopoda;

H. L. Sorensen, Beretning om in botanisk Reise i Omegnen af Fæmundsen;

J. Thuesen, Beretning om Fiskeri-Udsteblingen i Aalsund, 1864; and

C. M. Guldsberg et P. Waage, Études sur les affinités chimiques.

Kaserliche Akademie der Wissenschaften, Wien: Math.-Naturw. Classe, Sitzungsberichte, Band 54, I Ab., Heft 4--5, II Ab., Heft 2; Band 55, I Ab., Heft 1--5, II Ab., Heft 1--5; Band 56, I Ab., Heft 1.

Königl. Physikalische-ökonomische Gesellschaft, Königsberg: Schriften VI--VII, 1865--6.

Mr. Smith presented part 2 of his paper entitled "Flora of the Lower Country of South Carolina, reviewed." *

MAY 14TH, 1868.

The President in the Chair.

Books Received.

Der Zoologische Garten, 1867, Heft 7--11.

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* See Journal Ell. Soc., Vol. I, Art. 1.

Kaiserliche Akademie der Wissenschaften, Wien: Lucien Papelland, Études sur les Médications Arsenicales et Antimoniales et sur les Maladies du Cœur.

Academy of Sciences, Chicago; Act of Incorporation; Proceedings, Vol. I, pp.1--48; and Transactions, Vol. I, pt. 1.

Public Library of Cincinnati; Rules, By-Laws, Reports, &c., 1867.

Prof. McCrady tendered the resignation by Dr. G. E. Trescot, of the office of Recording Secretary, which was accepted, and Mr. W. G. Mazÿck was appointed to fill the vacancy so made.

JULY 9TH, 1868.

The President in the Chair.

Books Received.

American Athenæum, Vol. I. No. 20.

The Galaxy, June, 1867.

Jeffries Wyman, M. D., Observations on Crania.

Peabody Museum of American Archæology and Ethnology, Cambridge: Reports, 1868.

U. S. Naval Observatory: Astronomical and Meteorological Observations, 1865.

Zoologische-Mineralogischen Verein, Regensburg: Correspondenz-blatt, 1867; and

Verzeichniss der Sammlungen, 1867.

K. K. Zool.-Bot. Gesellschaft, Wien: Verhandlungen, Band XVII.

Naturwissenschaftliche Gesellschaft Isis, Dresden: Sitzungsberichte, 1867, Nos. 4--9.

Phys.-Medic. Gesellschaft, Würzburg: Zeitschrift, Band 6, Heft 4.

G. W. Niessl, Untersuchungen über die Genauigkeit des Nivelirens und Distanzmessen nach der Stampfer 'schen Methode, 1864.

August Neilreich, Diagnosen der in Ungarn und Slavonien bisher beobachteten Gefässpflanzen welche in Koch's Synopsis nicht enthalten sind.

J. Schumann, Die Diatomeen.

J. Winnertz, Beitrag zu einer Monographie der Sciarinen.

Jeffries Wyman, M. D., On Symmetry and Homology in Limbs.

Académie Royale des Sciences, Amsterdam: Verslagen en Mededeelingen, Afd. Letterkunde, 10re Deel, and

Processen-Verbaal, Afd. Naturkunde, 1866.

Donations to the Collection.

Eggs and Caterpillars of *Psyche serratella?* *Presented by Mr. W. Wragg Smith.*

On motion, a Committee was appointed to prepare a Memorial Page, to be inscribed with the names of the deceased active mem- of the Society.

Mr. Smith made an oral communication concerning the Caterpillars presented by him.

AUGUST 13TH, 1868.

The President in the Chair.

Books Received.

Royal Society of London: Proceedings, Vol. XVI., Nos. 95--100.

Alexandre Schyanoff, Essai sur la Métaphysique des Forces. *From the Author.*

Donation to the Collection.

Skull of Kanaka Indian, from the Sandwich Islands. *Presented by Dr. J. F. M. Geddings.*

Prof. McCrady read a "Description of Two New Genera, and Two New Species of Annelides,"[*]

Dr. C. F. Panknin read a paper "On a means of preventing the destruction of plants by Caterpillars, particularly the Cotton Plant."[†]

The Committee appointed at the last meeting to prepare a Memorial Page, to be inscribed with the names of the deceased active members of the Society, submitted its Report which was accepted, and the accompanying Page was ordered to be published with the Proceedings of the Society.

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[*] Prof. McCrady retained all of his papers, he has since deceased, and the MSS. cannot now (1885) be found.

[†] Not received for publication.

THIS PAGE

IS,

BY THE UNANIMOUS VOTE OF THE MEMBERS

OF THE

ELLIOTT SOCIETY OF SCIENCE AND ART,

INSCRIBED

TO THE MEMORY

OF

PETER CORDES GAILLARD, M.D.,	Died Jan'y 14, 1859 ;
HENRY WM. PERRONEAU,	Died March 30, 1859 ;
WM. McKENZIE PARKER,	Died Dec. 7, 1860 ;
Rev. FELIX J. CARR,	Died Aug. 8, 1861 ;
Hon. MITCHELL KING,	Died Nov. 12, 1862 ;
WM. HENRY WRIGHT, M.D.,	Died Feb'y 17, 1863 ;
Hon. JAMES LOUIS PETIGRU,	Died March 9, 1863 ;
JULIUS T. PORCHER, M.D.,	Killed in battle at Missionary Ridge, Georgia, Nov. 25, 1863 ;
PLOWDEN CHARLES J. WESTON,	Died Jan'y 25, 1864 ;
WM. LENOX MOULTRIE, M.D.,	Died May 18, 1865 ;
JOHN BALL WARING, M.D.,	Died Nov. 7, 1865 ;
THOMAS B. BENNETT,	Died March 25, 1866 ;
HENRY RUTLEDGE FROST, M.D.,	Died April 7, 1866 ;
EFFINGHAM WAGNER,	Died August 8, 1867 ;
R. B. CHAPMAN,	Died April 30, 1868 ;
Hon. EDWARD FROST,	Died July 21, 1868 ;

MEMBERS OF THE SOCIETY, DECEASED SINCE THE PUBLICATION OF

THE FIRST VOLUME OF ITS PROCEEDINGS.

SEPTEMBER 10TH, 1868.

The President in the Chair.

Prof. McCrady read a paper "On a Brachiopod Larva, and the Classification of the Acephala." *

Mr. W. Wragg Smith read the first part of a proposed series of papers entitled "The Autumnal and Winter Aspects, Coloring and Fall of the Leaves, together with other natural adjuncts, relations, and associations of Trees and Shrubs in the Low Country of South Carolina." †

OCTOBER 8TH, 1868.

W. WRAGG SMITH, Esq. in the Chair.

Prof. McCrady read a continuation of his paper on "The Law of Development." ‡

DECEMBER 10TH, 1868.

The President in the Chair.

The President laid before the Society specimens of a Fern, an undetermined species of *Pteris*, found about a month since, in fruit, in Wentworth St., near the corner of Rutledge, growing on the brick foundation of a wooden house, on the South side of the street. This brick foundation rises about a foot above the brick sidewalk of the street, is damp, and occupied by *Reboulea hemispherica,* and similar Hepatics and Mosses, which delight in such damp and shaded situations. Among these the Fern is growing freely, and it is like none of those known to inhabit this State. Its origin, and the time of its introduction are unknown.

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* See Note, page 58.

† Mr. Smith retained this paper, he has since deceased, and the MSS. cannot now (1885) be found.

‡ See Journal Ell. Soc., Vol. I, Art. 3, also Note, p. 58.

A letter of resignation from Hon. Wm. Aiken was read and accepted.

Prof. McCrady read a continuation of his paper on "The Law of Development." *

The following paper was read:

ON THE OCCULTATOR.

BY PROF. LEWIS R. GIBBES.

In the years 1848–1854, I was much engaged in observing occultations of fixed stars by the moon, and as a means of obtaining the approximate times of disappearance and reappearance with less labor than by calculation, I devised and constructed, in 1849 or 1850, an instrument for that purpose, to which I gave no special name. This instrument is still in my possession, but not in use, as certain parts, presently to be mentioned, have deteriorated with the lapse of time.

The Rev. Thomas Hill, of Cambridge, Mass., has published in the Nov. number of Silliman's Journal, a description and figure of an instrument for the same purpose, invented by him in 1842, and called by him the Occultator. As the two instruments have the same end in view, there is a general agreement in plan, but the details differ. Mine is founded on the well known method of orthographic projection usually adopted in projecting eclipses and occultations, and I have published no description of it, nor do I propose doing so at the present time; but I wish to mention now, the devices I adopted to overcome certain difficulties which present themselves in both instruments, and the following explanations will be sufficiently intelligible, without a figure, to those familiar with the subject.

Mr. Hill finds the desired projection, on the plane of the instrument, of any point above that plane, as the extremity of a steel rod, by means of a silk thread stretched on a brass bow, set on a triangular base, and made normal to the chart or plane of the instrument, by screws in the base. I effect the same end very simply and readily by the following expedient, based on the optical principle that an incident ray and the corresponding reflected one *coincide when they are normal to the reflecting surface.* A bit of a good glass mirror with parallel surfaces, and a few inches square, having two lines traced on it with a writing diamond perpendicular to each other, is placed on the plane of projection, and moved under the given point, representing the place of observation, until by the eye placed above that point and close to it its image is seen to coincide with the intersection of the lines on the glass. Evidently, this intersection is then the projection required on the plane of the mirror, and the corresponding point on the plane of the instrument is easily determined, if desired, by the use of the intersecting lines as lines of reference. In my instrument there is no necessity for determining this point on the plane of the instrument, as the time of disappearance is found by moving the point representing the place of observation, and the disc representing the moon, to successive corresponding positions belonging to successive minutes of time, until *the image of the point is occulted by the disc;* the time of reappearance is determined in like manner. Instead of the pointed extremity of the rod, may be used a minute perforation in a thin sheet of metal or of pasteboard, through which may be viewed its image in the mirrors. If instead of either of these, were used a polished bead of glass or metal, smaller than the pupil of the eye, the light reflected from it would be seen in the mirror as a star-like point, which by the principles of the projection employed, would be the representatives of the star to be occulted, and by the interposition of the disc representing the moon, would actually disappear and again reappear, as in an occultation. The use of the minute perforation gives the best results, as the eye cannot then fail to be in the proper position above the point indicating the place of observation.

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* See Note page 61.

I use the same method for adjusting in position a plane which in my instrument represents the plane of the parallel of latitude of the place of observation; this revolves about an axis, to which ought to be parallel the plane of the instrument or the chart, and this parallelism I test by finding, by reflexion, the projections of a certain point in three or more widely distant inclined positions of the plane; these projections ought to lie in a right line. This plane ought also to form with the plane of the instrument, or plane of projection, an angle equal to the complement of the declination of the star, and any line in it, perpendicular to the axis of rotation, being taken as radius, will have its projection equal to the sine of the declination. Having a scale of equal parts, for sines, drawn on the plane of the instrument, corresponding to a certain line in the movable plane as radius, I take from a table of natural sines the proper length for the given declination, and placing the intersection of the cross lines on the mirror, to coincide with the proper point in the scale for sines, I rotate the plane about its axis, until the image of the extremity of the radius adopted coincides with the center of the cross; the plane will then have the proper angle, without requiring an arc divided into degrees and parts as in Mr. Hill's instrument.

Mr. Hill mentions several methods of adjusting the varying relation between the moon's hourly motion and semi-diameter, and decides finally upon a fixed permanent scale, in inches and parts, for hourly motion, and calculates the corresponding values of semi-diameter and parallax, in order to avoid the labor of dividing in every case the moon's hourly motion along its path into minutes of time. I adopt a permanent scale of ten inches for the earth's radius, (which fixes moon's semi-diameter also) compute the value on this scale for the hourly motion of the moon in her orbit, from the horizontal parallax and hourly motions in R. A. and Dec., for each occultation, and adjust the instrument for this varying quantity, by using a scale of equal parts for minutes of time, *laid down on an extensible sheet.* This sheet is of caoutchouc, and *the scale is made variable by extending the sheet,* until sixty minutes or one hour on the scale corresponds in length with the computed value of the hourly motion of the moon. Two such scales might be used if the uniformity of the rate of extension of the sheet could not be trusted throughout the required extent of the variation of hourly motion in different parts of the orbit. These scales, made of the vulcanized caoutchouc obtainable at the date of the construction of the instrument. have now lost their elasticity and must be replaced before I can again use the instrument.

These expedients are simple, and I make them known, as the adoption of one or both may add to the efficiency of Mr. Hill's instrument, or similar instruments. I am not aware that any one had proposed them at the time I applied them to my instrument. I have heard that Mr. Adie of Edinburgh has proposed something similar to the last to thermometer scales I believe, but I do not know the date of his proposal, nor whether it has been adopted in the scales of any instruments.

Mr. W. Wragg Smith read a continuation of his paper on "The Fall of the Leaf, &c." *

JANUARY 14TH, 1869.

The President in the Chair.

Books Received.

Franz Gesellius, M.D., Capillar-Blut undefibrinirtes zur Transfusion.

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* See Note, page 61.

N. A. Pratt, M. D., Ashley River Phosphates, &c.

Donation to the Collection.

Helix aspersa, Smith's Lane, Charleston, S. C. *Presented by Mr. McCrady.*

Mr. Wm. G. Mazÿck exhibited an unusually large specimen of *Buteo borealis*, GMEL., killed near Oakley, S. C.

Mr. W. Wragg Smith read a continuation of his paper on "The Fall of the Leaf, &c." *

Prof. McCrady read a continuation of his paper on "The Law of Development." †

FEBRUARY 11TH, 1869.

The President in the Chair.

Dr. J. P. Chazal exhibited a specimen of *Stenorhinus sps.?* from Charleston Harbor, S. C.

Mr. Mazÿck mentioned the following species of Helix as having been found near Aiken, S. C., during the past summer by Dr. E. Ravenel, Sr.: *H. alternata*, SAY, *albolabris*, SAY, *Hopetonensis*, SH., and *Postelliana*, BLAND.

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* See Note, page 61.

† See Note, page 58.

Published Jan., 1886.

MARCH 11TH, 1869.

The President in the Chair.

Books Received.

Verein für Schlesische Insektenkunde, Breslau: Zeitschrift für Entomologie, Jahrgang I.

Naturwissenschaftliche Gesellschaft Isis, Dresden: Sitzungsberichte, 1868, Nos. 7--9.

Koninklijke Akademie van Wetenschappen, Amsterdam: Verslagen en Mededeelingen, Afd. Letterkunde, Deel XI; Afd. Natur. Deel II, Reeks 2;

Processen-Verbaal, Mai, 1867--Apl. 1868;

Catalogus van de Boekerij, Deel II, St. 2;

Jaarboek, 1867;

Kleine Schriften, XIII;

A. H. A. Ekker, Exeunte Octobri ad filiolum, and

S. A. Sexe, Crinoides Vivants.

Kaiserliche Akademie der Wissenschaften, Wien: Math.-Naturw. Classe, Sitszungsberiche, Band 57, Heft 1–3.

Kongelige Norske Frederiks Universitet, Christiania: Aarsberetning for Aaret 1867, med Bilage, and

Bidrag til Christianiasfjordens Fauna.

Naturforschenden Gesellschaft, Emden: M. A. F. Prestel, Die Winde über der deutschen Nordseeküste, &c., and

Jahresberichte, 1867.

Public Library Cincinnati: Rules, By-Laws, Reports, &c.

Mr. W. Wragg Smith read a continuation of his paper on "The Fall of the Leaf, &c." *

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* See Note, page 61.

APRIL 8TH, 1869.

The President in the Chair.

Mr. W. W. Smith exhibited a specimen of *Uredo candida*, with the following note:

Uredo candida, PERSOON.

I found this specimen in the "burnt district" which is a common for the cattle of the City. In some places the remains of old mortar and other cement are washed by rains and may be seen adhering to the leaves of the herbage occasionally. Associated with this is a dog-fennel which is whitened thus, and the casual observer might naturally conclude that the former was likewise a sprinkling of white plaster. But the appearance of organization in the regular coating on the leaves would induce further observation. This is a very common fungus, on the *Cruciferæ* chiefly, (*U. cruciferarum*, DECAN., *Cæoma candidum*, LINK, SCHW.) The present specimen is upon *Nasturtium tanacetifolium.* It is found also on *Portulacca* according to Schweinitz. The *Uredo* infests the inferior surface of the leaves, though occasionally it exhibits itself here and there on the upper. It first appears in roundish and oval tumors, some on the petioles, the sori, which are beautifully white, increasing in number and size until they anastomose and nearly cover the leaves. Sporidia white, globose-ovoid, with obtuse apices, pretty large, with apparently a pellucid central spot.

Prof. McCrady read a "Critique of Darwin's Theory of Pangenesis." *

APRIL 22D, 1869.

The President in the Chair.

Books Received.

Boston Society of Natural History, Proceedings, Vol. XII, pp. 113--304.

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* See Note, page 58.

Donations to the Collection.

Uredo candida, Persoon, *Botrytis epiphylla*, Link, and *Aecidium luminatum*, Schw. *Presented by W. Wragg Smith, Esq.*

Prof. J. McCrady exhibited a specimen of *Bulhus sps.?* from Florida.

Mr. Smith made the following remarks on the Fungi presented by him :

Uredo candida, Persoon.

The specimens shewn at a previous meeting were upon *Nasturtium tanacetifolium*, these appear upon *Capsella bursa-pastoris*, the "Shepherd's Purse," chiefly upon the rachis, continuously and completely enveloping it, sometimes to the extent of three inches or more, and on the inferior surface, more especially, of the leaves, sparingly on the pods, which, however, shrivel up and wither from its effects. The epidermis in this fungus is remarkable for its white, shining, porcelain-like appearance. Upon the slightest contact, it discharges a cloud of white dust which adheres, like wheat flour, to whatever it touches. Collected April 18th, during a drought.

Botrytis epiphylla, Link. (*Schw. Syn. N. A. Fungi, No.* 2645.)

Collected April 18th, during drought ; covering partially or totally the inferior surfaces of leaves of *Geranium Carolinianum** with a cinereous-white bloom, as it were. The opposite portions of the leaf exhibit, at the same time, first, pale, yellowish, convex spots, which soon become reddish brown and purple, and the leaf begins to wither. Fertile flocci pellucid, septate, strangulate, short-branched towards their summits with heaps of spores at the apices of the branches, which fly off at the slightest concussion and leave the flocci naked. Spores of the same color as the flocci, irregular in shape and size, ovoid, sub-cylindric-truncate, or angular, large, as if containing sporidia.

Æcidium luminatum, Schw. (*Syn. N. A. Fungi, No.* 2887.)

Common and prevalent, towards the close of April, upon the inferior surface of leaves of *Rubus trivialis*, the "low-bush blackberry," (always on leaves of the same year.) It covers the entire surface except the midrib and primary veins, curling up the leaves and attracting notice by its bright, fiery red appearance, as though the leaves were scorched by flames. Pseudo peridia at first suboval, elongating, then confusedly coalescing, soon breaking up lengthwise, shining, whitish or pale yellowish flesh-color. Sporidia bright orange or flame-colored, somewhat large, ovoid, (biseptate?) A lilac efflorescence, or purpuraceous stratum often takes possession of the vacant pseudo peridia, which is to all appearance some delicate species of mould.

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* Also on *G. maculatum.*

Prof. McCrady read a continuation of his "Critique of Darwin's Theory of Pangenesis." *

MAY 13TH, 1869.

W. WRAGG SMITH, Esq. in the Chair.

Books Received.

Boston Society of Natural History, Proceedings, Vol. XIII, pp. 305--336;

Occasional Papers, No. 1, Harris' Entomological Correspondence;

Memoirs, Vol. I, pt. 4, and

Working Map of North America.

Museum of Comparative Zoölogy, Cambridge: Reports of Trustees, 1867–8;

Rev. J. B. Perry, Queries on the Red Sandstone of Vermont and its Relations to other Rocks, and

L. F. Pourtales, Contributions to the Fauna of the Gulf Stream.

Zoologisch-Mineralogischer Verein, Regensburg: Correspondenz-Blatt, 1868.

Naturwissenschaftlicher Verein, Bremen: Abhandlungen, Band I, Heft 1.

K. K. Akademie der Wissenschaften, Wein: Math.-Nat. Classe, Sitzsungs-Berichte, Band LVI, Heft 2--5, I Ab.; Heft 3--5, II Ab.

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* See Note, page 58.

Der Zoologische Garten, 1868.

Naturwissenschaftliche Gesellschaft Isis, Dresden: Sitzungsberichte, 1868, Nos. 10--12.

Royal Society, London: Proceedings, Vol. XVI, Nos. 101--109.

A letter from the Reading Society of Natural Sciences, Reading, Pa., soliciting exchange, was read, and the request granted.

Mr. W. Wragg Smith was elected Librarian of the Society.

MAY 28TH, 1869.

The President in the Chair.

Mr. W. Wragg Smith exhibited a specimen of an undetermined Fungus growing upon *Pinus taeda.*

Mr. Smith read a continuation of his paper on "The Fall of the Leaf, &c." *

JUNE 10TH, 1869.

The President in the Chair.

Mr. Wm. G. Mazÿck exhibited specimens of *Aphis* infesting the leaves of Geraniums.

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* See Note, page 61.

JUNE 24TH, 1869.

The President in the Chair.

Prof. McCrady continued the reading of his "Critique of Darwin's Theory of Pangenesis." *

AUGUST 12TH, 1869.

The President in the Chair.

Books Received.

Encyclopedia Brittanica, 16 vols., and
Smollett's History of England, 3 vols. *From Robert Hume, Esq.*
Boston Society of Natural History, Proceedings, Vol. XII, pp. 401–416; Title, and Index.
American Philosophical Society, Philadelphia: Proceedings, Vol. XI, No. 81.

Mr. Mazÿck exhibited a plant in flower, from a bed where mustard seed from France was sown.

Mr. Smith read a continuation of his paper on "The Fall of the Leaf, &c." †

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* See Note, page 58.

† See Note, page 61.

AUGUST 26TH, 1869.

The President in the Chair.

Books Received.

Kaiserliche Akademie der Wissenschaften, Wien: Math.-Naturw. Classe, Sitszungsberichte, Band 57, Heft 4--5, I Ab.; Heft 4--5, II Ab.; Band 58, Heft 1.

Physic-Med. Gesellschaft, Würzburg: Sitzungsberichte, 1868.

Contributions to the Collection.

Leaves of *Robinia pseudacacia* mined by the larva of *Lithocolletis Robinella*, CLEMENS. Charleston, end of May;

Depazea catalpae on the superior surface of the green growing leaf. Charleston, May.

Depazea sps.? on *Cornus Asperifolia.* Mt. Pleasant, S. C., June.

Galls of the High-bush Blackberry. June, and

Thelephora cespitulans, SCHW.? at base of *Broussonetia*, July. *From Mr. W. W. Smith.*

Prof. McCrady continued the reading of his "Critique of Darwin's Theory of Pangenesis." *

Mr. Smith stated that the plant exhibited at the last meeting was *Euphorbia variegata*, NUTT., a native of Western Louisiana.

SEPTEMBER 9TH, 1869.

W. WRAGG SMITH, Esq. in the Chair.

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* See Note, page 58.

Contributions to the Collection.

Tooth of *Ischyrhiza mira,* Leidy, from near Effingham, Marion Co., S. C., and

Cast of *Lingula ?* *From Mr. W. G. Mazyck.*

Prof. McCrady read a paper on "The Position of Humboldt in Science." *

SEPTEMBER 22d, 1869.

W. Wragg Smith, Esq. in the Chair.

The Chairman exhibited a specimen of Caterpillar, *Ceratoma quadricornis,* Harris, accompanied by the following descriptions and remarks:

Ceratoma quadricornis, Harris.

"Caterpillar when first hatched, yellowish green, with a darker dorsal line, a long, red, caudal horn, and a very large, green head, with the dorsal denticulations and tubercles obsolete. Pupa thick, not elongated before; tail ending with a conical projection, tipped with two little divaricating spines; tongue-case buried and soldered to the breast." (*Harris' Correspondence, p.* 232.)

"*Ceratoma* (Harris) *quadricornis,* (Hubn.) Mature Larva. Head pale green, with an indistinct whitish lateral stripe. Body pale green, becoming, just before pupation, in one of the sexes, more or less reddish brown, dotted with obscure granulations; lateral stripes pale greenish with whitish granulations and two thoracic, dorsal, white, granulated lines; caudal horn greenish; stigmatæ black, encircled with yellow and divided by a yellow line. Feet reddish or tipped with reddish. Length about three inches. The larval transformation is subterranean. Pupa dark brown, smooth, cylindrico-conical; tongue-case not apparent. The larva reaches maturity about the beginning of

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* See Note, page 58.

Published Feb., 1886.

September, and appears as an imago during the following May or June. The larva feeds on the leaves of *Ulmus Americanus.* Massachusetts, Pennsylvania, Michigan. (*Clemens, Lepidoptera of N. A., Smithsonian Misc. Collections.*)

The mature larva was found by me in the streets of Charleston, where there were Elm trees, Sept. 23d. Length three and a half inches; thickness nearly three-quarters of an inch. Head finely granulated, having, in addition to the two lateral stripes, two in front, approximate and nearly obsolete. There were some slight brownish or livid blotches, like bruises, on the flanks, front and hind parts of this individual. Dorsal white line very distinctly denticulate with erect teeth. Lateral whitish stripes oblique, the upper portions more strongly denticulate, the lower granulate, seven in all, except two others, more abbreviated, each side between them and the dorsal line in front, and leading to the four horns. Horns, or tubercles, about one-tenth of an inch long, strongly granulated with white and a slight tinge of purple, pointing forwards; the front pair just above the middle pair of feet, the hind over the third or last pair. Stigmatæ oblong-oval, one-twentieth of an inch long, pale yellow, enclosing two vertical, parallel black lines. Caudal horn one-third of an inch long, but slightly recurved.

OCTOBER 28TH, 1869.

The President in the Chair.

Contributions to the Collection.

Oiketicus coniferarum, from Cedar trees in Charleston. Collected in September and early in October, *viz.*: two males of the imago; cocoons or houses of each sex with their silk, some with male chrysalis appendant and protruding but emptied, and some with the female enclosed containing eggs. *From Mr. W. Wragg Smith.*

Prof. McCrady continued the reading of his paper on "The Law of Development." *

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* See Note, page 58.

JUNE 9TH, 1870.

W. WRAGG SMITH, Esq. in the Chair.

Books Received.

Boston Society of Natural History, Proceedings, Vol. XIII, pp. 161--272;

American Museum of Natural History, New York: Report, 1870.

Museum of Comparative Zoölogy, Cambridge: Bulletins 8--13.

American Philosophical Society, Philadelphia: Proceedings, Vol. XI, Nos. 82--83.

Donation to the Collection.

A specimen of *Saturnia io*, and two Butterflies, one of which was taken *January 8th. From Dr. J F. M. Geddings.*

AUGUST 11TH, 1873.

The President in the Chair.

Prof. McCrady made a lengthy verbal communication, illustrated by diagrams on the black-board, concerning the anatomy of *Lingula* and the development of its ova.

AUGUST 25TH, 1874.

The President in the Chair.

Mr. Mazÿck exhibited a collection of rare and valuable Land Shells from Australia and the Islands of the South Pacific Ocean.

OCTOBER 26th, 1875.

The President in the Chair.

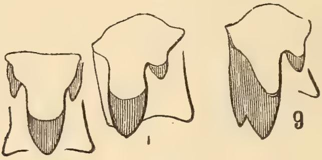
Mr. Mazÿck read the following note on the occurrence of

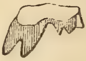
HELIX TERRESTRIS, CHEMNITZ, IN NORTH AMERICA.

BY WM. G. MAZYCK.

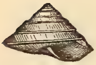
In July last, I accidentally discovered a number of dead shells of *Helix terrestris*, Chemnitz, in St. Peter's (Episcopal) churchyard, in Logan Street, in this City, but, notwithstanding a most diligent search, no living examples of the species could be found at that time, owing, probably, to the prevalence of an almost unprecedented drought.

In September, I was, however, fortunate enough to secure two living specimens, which were sent for examination to my friend, Mr. W. G. Binney, who kindly furnishes the following description of the jaw and figures of the lingual dentition :—





"Jaw slightly arcuate, low, wide ; ends blunt, slightly acuminate ; anterior surface with over 14 broad, crowded, flat ribs, slightly denticulating either margin."



H. terrestris. (enlarged.)

Von Martens, (Albers' Heliceen, p. 116,) places the species in the sub-genus *Turricula*, Beck, giving as its habitat, "Italy and Southern France." I have never heard of its occurrence elsewhere until its discovery in Charleston, where it exists, as far as I can ascertain, only in St. Peter's churchyard, accompanied by *Helix aspersa*, Muller, *H. hopetonensis*, Shuttlw., *Zonites minusculus*, Binn., *Pupa marginata*, Say, and *Stenogyra decollata*, L., which latter is exceedingly abundant throughout the City.

St. Peter's Church was burnt in the great fire of December 12, 1861, at which time the greater portion of the shrubbery of the graveyard was also detroyed. The ruins of the building were removed about two years ago, and, the shrubbery not having been renewed, there is but little shade, a circumstance which has, doubtless, greatly retarded the propagation of the species which has probably existed in small numbers for several years in this very restricted locality.

I am indebted to Mr. Thomas Bland for the determination of the specific name.

Specimens of the dead shells have been deposited in the Museum of Comparative Zoology, Cambridge, Mass., in the cabinets of Mr. W. G. Binney and Mr. Thos. Bland, and may be seen in my own collection.*

Dr. G. E. Manigault made a verbal communication concerning the head of the Rattlesnake, with special reference to the loss and reproduction of its fangs, and the manner in which the poison is injected into a wound.

By an examination of the osteology of the head and the attachment of the fangs to the upper jaw, it would appear that the canal occupying the centre of each fang, through which it is commonly supposed that the poison is admitted to a wound, is not open at its base, and consequently does not communicate with the poison gland. When a fang that has been broken off from the head is examined, the canal is found to be quite large at its base and entirely open, but reference is now made to the fang as attached to the head, when no opening at its base can be observed. The conclusion naturally follows that the poison is injected into the wound by being around the fang, and not from having passed through it. The specimen examined is *Crotalus adamanteus*, the largest of the many varieties of rattlesnake, which is confined to the seaboard of North and South Carolina, Georgia and Florida. In addition to the fangs which are in position are four others on each side, in successive stages of growth, all of which are, during life, held in a fold of the mucous membrane of the mouth. This large supply of constantly growing fangs would appear to indicate that, whenever a wound is made by the snake, the fangs are probably broken off, and, while the digestion of the animal that has been swallowed is going on, there is time for two other fangs to be secured to the jaw by bony attachment.

The following paper was read:

SYNOPTICAL TABLE OF THE CHEMICAL ELEMENTS.

BY PROF. LEWIS R. GIBBES, OF COLLEGE OF CHARLESTON, S. C.

From time to time, during the last twenty-five years, the attention of Chemists has been directed to the numerical relations of the atomic weights of members of the same group of chemical elements, and also to like relations between members of different groups.

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* This Note was published in the Proceedings of the Academy of Natural Sciences of Philadelphia, 1876; the cut of the lingual dentition was kindly loaned by the Academy, that of the shell, an electrotype of Mr. Binney's fig. 508, Manual American Land Shells, was obtained through the courtesy of the Smithsonian Institution. W.G.M., Feb., 1886.

At the meeting of the British Association in 1851,[*] Dumas shewed that the successive atomic weights of the members of a group, from least to greatest in order, might in many cases be expressed by an equation of the form, $aA+bB+cC$; in which A, B, and C were properly chosen constants for each group, A being atomic weight of the first member, and a, b, c, might vary from member to member, though in most cases a was constant and equal to 1; b was 0 for first member, c was 0 for first two members and then might vary from member to member, but were small numbers never greater than 7 or 8. He also shewed that in several groups three of the members would form an *arithmetical* or *equidifference series*, sometimes exactly, in general very approximately. These sub-groups he called "triads" but not in the sense in which that term is now used in chemistry. These "triads" would of course be formed when in a group three equations occurred, such, for example, as the following:

$$\begin{array}{lclclc} A+B & & A+B & & A & \\ A+B+C & \text{or} & A+4B & \text{or} & A+B & \text{\&c.} \\ A+B+2C & & A+7B & & A+2B & \end{array}$$

In 1853[†] Gladstone discussed the same subject in an article on the "Numerical Relations of Atomic Weights," using the numbers given in Gmelin's Handbook, in order "to avoid the objection that his mind had been biassed by dwelling on the numerical relations." In 1854 J. P. Cooke arranged the elements in numerous groups or series by their numerical relations, and in 1857 Odling considered these relations in an article[‡] on the "Natural Groupings of the Elements," using the numbers in Miller's Elements of Chemistry.

In 1858 and subsequent years Dumas[‖] pointed out the "parallelism" between corresponding members of a pair of groups, indicated by the nearly constant difference between the atomic weights of corresponding elements in each group, and shewed that this "parallelism" extended even to groups of compounds.

In 1858 Mercer[§] illustrated these relations in certain groups by diagrams, laying down the atomic weights and their differences, by scale, as ordinates, or parts of ordinates, to a line of abscissas.

In articles inserted in Watts' Dictionary of Chemistry, in 1863[¶] and 1868,[¶] Odling again discusses this subject with the aid of later chemical views and knowledge; and in 1869 one writer in the American Supplement to the Chemical News called attention to "the pairing of the artiad and perissad Elements," and another to certain relations presented in the linear arrangement of points corresponding to the atomic weights when laid down in diagrams similar to those of Mercer already mentioned.

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[*] Dumas, Sill. Jour., 2, XII, 275, 1851; 2, XXV, 267, 1858; 2, XXVI, 259, 1858.

[†] Gladstone, L. E. & D. Phil. Mag. 4 V. 313, May, 1853 with DeMorgan's Note on probabilities of occurrence.

[‡] Odling, ib. 4 XIII, 423, 480, June and July, 1857; Report British Association, 1858.

[‖] Dumas, Phil. Mag. 4 XVI, 209, Sept. 1858; Sill. Jour. 2 XXVII, 253, 1859.

[§] Mercer, Report British Assoc. 1858.

[¶] Odling, Watts' Dict. Art. Atomic Weights, and Metals.

In consequence of the various changes introduced by later researches, several of the equations or formulæ of the earlier of the above mentioned writers are no longer applicable, or would not now be true for the values of the atomic weights at present in use, and in a rapidly advancing science like Chemistry. no attempt at a systematic view of these relations can yet hope to have a permanent value.

In endeavouring to construct a Table to exhibit in the lecture-room a synoptical view of the Elements and their relations as developed in modern Chemistry, I have availed myself of all the hints derivable from the views of the above mentioned writers. The relations I desired to exhibit were these :

1. The Groups of Elements, as at present recognized,
2. The Atomic Weights of each Element, as now adopted,
3. The Character of each, as Perissad or Artiad,
4. Their Atomic equivalence or Atomicity, as Monad, Dyad, Triad, &c.,
5. Their Electro-chemical character, as Electro-positive or Electro-negative ;

and to avoid undue bias as to numbers, groups, &c., I adopted as guide the tables at pages 14, 16, and 19 of Barker's Text Book of Chemistry, which tables I shall call I, II and III. To obtain the advantages presented by a single table, some of those belonging to the separate tables must be sacrificed. I determined, to abandon entirely the linear or serial form of table II, to divide the electro-chemical series into three approximately equal portions, to regard the upper or negative third as containing the most intensely electro-negative elements, the lower the most intensely electro-positive, and those embraced in the middle third as of mean or average character in the electro-chemical series, and then to rest satisfied with the approximate representation in my Table of the general character of each of these three divisions. As the atomic equivalence or degree of atomicity is not fixed, while the perissad or artiad character seems invariable, I determined to preserve this last character inviolate, and to express only one degree of atomicity, and that the most decided one as given in table III. After trying several forms of arrangement for my Table, I have finally adopted the following, which presents I think a striking view of the relations of the several groups of Elements, and as it may prove useful to those who like myself are engaged in teaching, I will make it known. The mode of arrangement has some novelty, and may present one or more known relations in a new light. After having served its purpose, it must give way, as have done its predecessors, to the new forms of arrangement required by the progress of Science.

TABLE OF CHEMICAL ELEMENTS.

a	SERIES.									GROUPS.
	A	B	C	D	E	F	G	H, I	K	
−4		C=12	Si=28	Ti=50			Sn=118			Silicon Gr.
−3		N=14	P=31	V=51.3	As=75	Cb=94	Sb=122	Ta=182	Au=196.6	Phosphorus Gr.
−2		O=16	S=32	Cr=52.5	Se=79	Mo=96	Te=128	W=184	Os=199	Sulphur Gr.
−1		F=19	Cl=35.5		Br=80		I=127			Chlorine Gr.
0										
+1	Li=7	Na=23	K=39		Rb=85	Ag=108	Cs=133		Tl=204	Kalium Gr.
+2	Gl=9.3	Mg=24	Ca=40	Zn=65	Sr=87.5	Cd=112	Ba=137		Pb=207	Calcium Gr.
+3	−B=11								Bi=210	
Al=27.5——Cr=52.5 ; Mn=55 ; Fe=56 ; Co=59 ; Ni=59 ; Cu=63.5——U=120										Iron Gr.
Y=61.7				Zr=89.5;Ce=92 ; La=92 ; D=96				Er=112 ; Th=115.7		
In=74					Ru=104;Ro=104;Pd=106——Pt=197 ; Ir=197					Platinum Gr.
					H=1		Hg=200			

The above Table is a copy of that now hanging in my lecture-room, which is modified in some degree from the one constructed last year. The chief novelty in their construction is the *inversion* of each half of the well known table of Electro-chemical Series. (Barker's table II, p. 16,) by which change I bring into *proximity* the elements which lie at the *extremes* of the Series, and so, instead of *separating* those groups which exhibit the highest degree of electro-chemical intensity, and have the strongest affinity for each other, I place them as near as possible. Taking the symbols and atomic weights from table I, p. 14, I write the *negative* monads, dyads, triads and tetrads, taken from table III, p. 19, in horizontal lines in order one above the other, and indicate their atomicities or atomic equivalence by −1, −2, −3 and −4, respectively, in the first column on the left; then, leaving an empty line or gap, marked by index 0, I write the *positive* monads and dyads below this empty line, successively one below the other, and give them the indices +1, and +2, respectively. Among the positive monads I include Ag and Tl, and among the positive dyads, besides Gl, also Zn, Cd and Pb, and among negative tetrads Sn, for which several steps good reasons may be given, and to which probably no serious objection will be made. In each horizontal line the Elements are written in the order of their atomic weights increasing from left to right, and are also arranged in vertical columns, as seen in the Table, guided by the order of succession of those numbers. The Elements belonging to each horizontal line, I shall call a Group, and indicate it by the number or index, with its sign, in the first column ; those in each vertical column, I shall call a Series, and indicate it by the capital letter written at the top of each column.

Now reading each Series downward, beginning with A, and following the order of the letters, a remarkable regularity will be observed in the succession of the numbers, as far as the arrangement has been now described, yet with gaps unfilled by numbers in several of the groups. Influenced and guided by this order of succession, I now make the following deviations from the arrangement of Barker's tables. I transfer the negative pentad V to group —3, placing it in series D, between P and As, which step is permitted, since the perissad character is still maintained and indicated, and may be supported by urging the likeness in constitution and crystalline form between Pyromorphite and Vanadinite, between Thrombolite and Volborthite, &c. In the same group I place the pentad associates of V namely Cb and Ta, giving them the places seen in the Table. I also place the negative hexad Cr in group —2, on the ground of the analogy between the Sulphates and Chromates, and with it its negative hexad associates Mo and W. I place also in series K, the triad Bi in group or line +3, the triad Au in group —3, and the hexad Os in group —2, induced chiefly by the values of their atomic weights but in the case of Os also by its combustibility when in fine powder, and by the pungent peculiar odour of the resulting oxygen compound, in which respects it resembles S, Se, and Te. The only perissad now remaining, except H, is B, a triad contained in the negative third of table II, but no suitable place can be found for its atomic weight in group —3, and I place it in group or rather line +3, Series A, where it finds a suitable place in the succession of numbers, and I mark it, as an estray, with the negative sign.

If it be objected that, in all these cases of the last section, chemical relations, to exhibit which is the object of the Table, have been set aside, and the numerical relations allowed to have too great sway, then two lines must be added to the Table, above line — 4, with the indices —5 and —6. The triad B must be placed in line —5 in series B, where its negative and perissad character are both indicated, and its atomic weight accords with the series of numbers below it. The pentads V and its two associates must be carried to line —5 their appropriate location, and the hexads, Cr, Mo, W and Os to their own in line —6; but then the orderly succession of numbers can no longer be preserved in the series to which they belong.

If however we take the Table as it is presented above, the continuity or regularity in the series of numbers is very striking, the perissad or artiad character of each element is preserved throughout, also, with a few exceptions, the prominent degree of atomic equivalence, as monad, dyad, &c., is well preserved and indicated ; the electro-chemical character, in addition, is very fairly presented, indeed to such a degree, that no member of the electro-positive third of Barker's table II is to be found in the negative portion of our Table, nor any one (except B above mentioned) of the electro-negative third of table II, in the positive portion; in each of these portions, a few elements appear belonging to the middle third of table II, which includes those of less decided electro-chemical character than in the two other thirds.

Those who desire to express approximately any one series by an equation of the form $P+Qa$, may easily do so, by properly choosing the constants P and Q, and putting for a that number, *with its sign*, taken from the first column of the table, which expresses the degree of atomic equivalence belonging to the element whose atomic weight is required. For example, the atomic weight of any element in series A is expressed approximately by $5+2a$, in series B by $20+2a$, in C by $30+2a$, in E by $82\frac{1}{2}+2\frac{1}{2}a$, in G by $130+3a$, the precise atomic weight being given in many cases, the error, when occuring, being generally 1, in two cases $1\frac{1}{2}$, in one case 4. If it were worthwhile, values with fractions might be given in each series to P and Q, by which the maximum error might be much reduced, but then the sum of the errors would be distributed over all the terms of the series, the results of the expression or equation being by a small amount erroneous in each case. The numbers in the three series A, B, and C may be represented very closely by an arithmetical or equidifference series, whose first term is 7 (for Li) and equidifference is 2, the errors nowhere exceeding 1; with first term 6.6 and equidifference 2, the sum of the errors would be $+0.2$ and the errors would exceed 6.6 in but two cases the maximum error being 0.9. So the numbers from 108 to 137 will be approximately represented by an equidifference series whose first term is 109 (for Ag) and common difference 3, the error exceeding 1 for one element only. With first term 109.6, and same difference the algebraical sum of the errors will be reduced to -0.2, but the errors would exceed 1 in two cases. Of course it is understood that the series just mentioned furnish numbers to fill the gaps in line $+3$ and in line 0, although no Elements be there recorded in the Table, and it is somewhat remarkable that the numbers in the series which would correspond to line $+4$, if it were used in the Table, answer equally well for line or group -4, which lines are equally remote from the maxima of positivity or negativity; also numbers for $+3$ answer for -5. This will also be seen by using for series A the expression $5+2a$, for series B, $21+2a$, for series C, $37+2a$, instead of those given above; or taking the numbers actually recorded in the Table, Si $=28$ which stands in line -4 of series C, will numerically suit equally well for line $+4$ of series B; Sn$=118$ which stands in line -4 of series G, will suit very well for line $+4$ of series F; indeed as it is found near the middle of table II, it might well be placed in line $+4$, but its proper place is in -4, because of its relations with Ti as shown through Rutile and Stannite, &c.

The average difference for numbers on the same line in series B and C, and also in A and B, is 16; for C and E, the difference is about 46, and between E and G about 48 ($=3\times16$). Hence Dumas' "triads" appear in series A, B, C, on lines $+1$ and $+2$, and in series C, E, G, on each line except -4. If to each of these last, we prefix the numbers corresponding in series B, we shall have most of the *sequences* to which Dumas applied his equations of the form already given in the second paragraph of this paper; for example, the numbers in line -1, for this *sequence*, would be,

$$19,\ 19+1\times16.5=35.5,\ 19+2\times16.5+1\times28=80,\ 2\times19+2\times16.5+2\times28=127;$$

for line -2 they would be

$$16,\quad 16+1\times16=32,\quad 16+4\times16=80,\quad 16+7\times16=128;$$

for line -3, they would be,

$$14,\quad 14+17=31,\quad 14+17+44=75,\quad 14+17+2\times44=119,$$

and so for others; for the artiad lines, the numbers used by Dumas, were of course only half those of the Table, and the last number just given, 119, agreed better with the atomic weight of Sb used by Dumas, than with that at present received. It is worthwhile to remark, in connection with this part of our subject, that the numbers in line $+2$, are very approximately represented by the multiples of 8 upon the following numbers, 1, 3, 5, 8, 11, 14, 17 and 26, for the series, A, B, C, D, E, F, G and K respectively; hence it evidently follows, that this line or group will furnish no less than five of the "triads" of Dumas, namely 1, 3, 5; 5, 8, 11; 8, 11, 14; 11, 14, 17; 8, 17, 26. The numbers in line or group -2 are represented even more closely by the multiples of 8 upon 2, 4, 6½, 10, 12, 16, 23, 25, but they furnish only one "triad" 4, 10, 16. No number of the last series of multiples coincides with any one of the former, but the first three of the last series are arithmetical means between each pair of the first four of the former. It is also evident that the average difference between series B and each adjacent series is about $16=8\times2$, between each pair of series from C to G is about $24=8\times3$, and between G and K is $72=8\times9$; this last series is marked K to indicate this large interval from G, and the intermediate column is marked H, I, to indicate uncertainty as to the number of intervening or missing series, and the probability that there would be at least two, with common difference of 24; the only two numbers at present in column H, I, indicate a difference 15 with respect to series G, nearly equal to that existing between series A, B, C. Another mode of expressing or obtaining the numbers in line $+2$, is the following; it is allied to that of Dumas just given and may also be applied to the other lines in the Table is this:

for the series	A	B	C	D	E	F	G	K
write the numbers	0	10	32	55	78	102	126	198
their differences are		16	16	23	23	24	24	72

then to each of these numbers is to be added a certain constant quantity for each line of the Table; for lines -4, -3, -2, add -4, -2 and 0 respectively, for lines —1, +1, +2, +3, add +3, +7, +9, +11, respectively, and the results will be found in general very fair approximations to the corresponding numbers of the Table where they exist, with five exceptions V, Cb, Cr, Mo, and Sn. If we also except line +3, which has but two members not forming a proper Group, then the algebraic sum of the errors on the remaining 32 atomic weights will be +0.1, the errors nowhere exceeding +2 or —2.

The "parallelism" of the atomic weights pointed out by Dumas, so far as it really exists, may readily be recognized in almost any two lines of the Table, whether adjacent or not, and it is evidently included in, and expressed by the mode of approximating to these numbers just given in paragraph immediately preceding. As easily also can be seen the "pairing of the elements" mentioned by a writer in the Chemical News, which pairing is a "parallelism" with a difference not constant but small, extending over the whole series of perissads, and such artiads as nearly equal them, the latter greatly outnumbering the former.

Those who, with Mercer in 1858, and a writer in the Chemical News, 1869, prefer the form of a diagram, may draw a pair of rectangular axes, as in the subjoined figure, lay off on the horizontal one, right and left from the vertical one as positive and negative abscissas, the numbers a in the first column of our Table which mark the atomic equivalences, draw vertical ordinates through each point so found, and mark on these ordinates points, at heights, taken from a scale, corresponding to the atomic weights of the elements in the Group proper to each ordinate. The points indicating the members of each Series, will now be found to lie very approximately on a *right line*, these lines cutting the axis of ordinates at nearly the same angle. The "parallelism" will now be not only arithmetic but geometric, presented to the eye, and will be most striking in the case of series A, B, C, less so in case of D, E, and of F, G, K. Such a diagram may be found useful in instruction, and it will be convenient to take a unit for line of abscissas 10 to 15 times as great as that for the ordinates, giving about 10° for angle formed with axis of abscissas by lines of series A, B, C, and 15° for series G. That the angle will not be precisely the same for all the series is evident from the coefficients of a in a preceeding paragraph, 2 for series C, 2½ for E, 3 for G, and also from the differences of the numbers 0, 16, 32, 55, &c., just given above.

The remarkable continuity of the three series A, B and C, with the equality already remarked in the numbers corresponding to $a=+4$ in one series, and to $a=-4$ in the next, permits the construction of another geometric diagram, less convenient than the last for reference, but allowing the *three* series to be exhibited in continuity as *one*, that is by the use of an Archimedean Spiral whose radius vector increases by 16 units in one revolution. Draw eight lines radiating from one point and including 45° between each pair of rays, mark the extremity of one of these, suppose the downward one, with index 0, the three on the right with +1, +2, +3, successively, the three on the left, with —1, —2, —3, successively, the upward one with ±4. Mark on ray +1, by a scale, the points 7, 23, 39 corresponding to Li, Na, K, on ray +2, the points, 9, 3, 24, 40, on +3, mark 11, on ± 4, mark 12, 28, on —3, mark 14, 31, on —2,

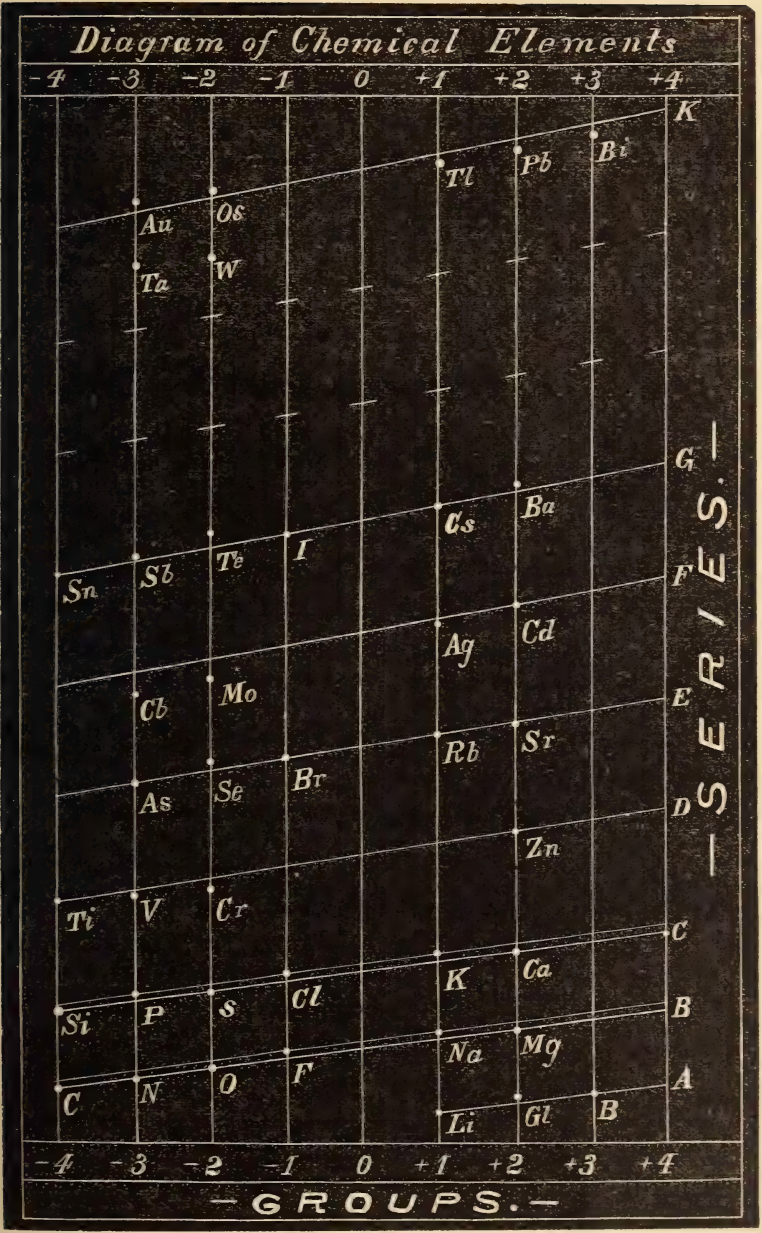
Diagram of Chemical Elements
-4 -3 -2 -1 0 +1 +2 +3 +4
K
Tl
Pb
Bi
Au
Os
Ta
W
G
Cs
Ba
Sn
Sb
Te
I
F
Ag
Cd
Cb
Mo
E
Rb
Sr
As
Se
Br
D
Zn
Ti
V
Cr
C
K
Ca
Si
P
S
Cl
B
Na
Mg
C
N
O
F
A
Li
Gl
B
-4 -3 -2 -1 0 +1 +2 +3 +4
—GROUPS.—
—SERIES.—

mark 16, 32, and on −1, mark 19, 35.5. Then an Archimedean Spiral constructed to pass accurately through points 7, 23, 39 on ray +1, will pass accurately through several of the others, and very near to each of the rest. It has already been remarked that element B=11 which stands in the table as a positive triad in series A, might be *transferred* as a negative pentad to series B, without marring the existing continuity of the whole series or sequence of numbers ; so Gl=9.3 and Mg=24 positive dyads in A and B might be placed, with the same numerical fitness, as negative hexads in series B and C. But in the diagram just described there will be no necessity for *removal*, the same end will be attained by continuing to read in the negative direction, past ±4 onwards to +3 now regarded as —5, and to +2, regarded as −6. If the diagram of preceding section with rectangular coordinates were wrapped around a cylinder whose circumference equals interval in diagram from +4 to−4, the result just mentioned would be exhibited with the same accuracy, a helix being substituted for the spiral.

Taking the series of numbers from Li=7 to Ba=137 it is evident that no straight line or linear equation, adjusted to give accurately certain atomic numbers, can give more than rude approximations to many of the others. Curve lines or equations of a higher degree than the last, may do better, as

$$w=7+\frac{27}{16}x+\frac{1}{51}x^2, \text{ or } w=8+\frac{23}{16}x+\frac{1}{28}x^2-\frac{1}{4200}x^3-\frac{1}{500000}x^4,$$

where w signifies the atomic weight required, and x the number of *steps* or the distance from Li=7, counting every line and unfilled gap as one step including those of line whose index $a=0$ in first column, for an equation ought to fill every gap. By using more complex fractions for the coefficients, better results would be obtained in several cases, if it were worth while to compute them, but it is not difficult to see that curves which would give closer approximations than the above, must have two points of inflection, or contrary curvature, one between the ordinates or numbers 40 and 50, the other somewhere between 87.5 and 108, and if V, Cr, Cb, and Mo be retained in the places now assigned them, it may become worth our while to construct equations for such curves, especially if any of the gaps now existing were filled by discovery of new elements. We might use a transcendental equation such as

$$2.0531+.0067x=\text{com. log. of }(w+105),$$

but the remark just made shews that it can give tolerable approximations only in certain parts of the series.

But all these processes are *arithmetic* or *geometric* exercises, and though it be curious or remarkable that such manipulations are possible with numbers expressing *chemical* relations, we must beware of laying undue stress upon them. None of the equations or constructions give results exactly coinciding with the atomic weights throughout any one series of numbers, and in not a few cases the values of the atomic weights themselves, cannot be regarded as yet definitely settled. It is true, some of the weights ultimately adopted may coincide more nearly with the results of the above processes, but it is, at least equally possible that they deviate farther, and if chemical analogies or relations require large deviations, such as the halving or doubling of some of these weights, our arithmetic and geometric structures will give way at once. The *possibility* of finding for the numerical series of atomic weights such expressions as above given is not to be overlooked, since these expressions may lead to the perception of new chemical relations, but they must hold a subordinate place until such relations have been brought out. A certain succession of numbers being given, with tolerable regularity of sequence, some latitude permitted in choice of constants, and at same time a moderate deviation being allowed for errors of computed results, it generally would not be difficult to find one or more algebraical expressions for the terms of the sequence, fulfilling certain conditions of approximation. It is not impossible that formulæ yet more complex, or of forms more peculiar, might be found yielding results still more closely agreeing with the atomic weights of the table, even when the order of sequence should sometimes be *inverted*, as would be the case if V, Cb, Ta were removed to line —5, and Cr, Mo, W to line —6.

In that portion of our Table that we have had under consideration is contained all the perissads, save H, and many artiads; but there still remain a large number of the latter to be considered, for which can be found no suitable place in the preceding scheme. These I arrange in groups in lines below the former, but separated from them by a horizontal line drawn through the table. They lie therefore on the positive side of line whose index is 0, and are thus properly placed except Cr, for all the rest lie in the positive third of table II, p. 16, except the Platinum group, which lie in in the middle third and may be placed here without violating the principles adopted for the construction of the Table. In the first of these lines is the Iron Group, well recognized, and remarkable for the small range of the atomic weights of its five chief members, Cr, Mn, Fe, Co, Ni. To the addition of Cu to this group some may demur; none will object to prefixing Al, separated and yet connected by the dash, nor probably to annexing, with similar dash, the element U, supported by the analogy of Uraninite with Magnetite, Franklinite, &c. It is remarkable that the atomic weights of two of the members of this group are identical, and the *half* of that of the extreme member nearest to them would differ from their own by 1; also that the weights of two other members differ by 1, while the *double* of that of extreme member nearest to them will coincide with the weight of one of them. The elements on the next line below I can scarcely call a group, but write them here to shew the remarkable "parallelism" of five of their number, Y, Zr, Ce, La and D, with those members of the Iron Group under which they are written. The other two, Er, Th, are written here for a reason, very unscientific indeed, but not without influence I imagine, in other schemes than the present,—I know not where else to put them. I am not sufficiently familiar with the elements on this line to make a better arrangement. In the next line. I place the Platinum group, prefixing In, and arranging them so as to exhibit the "parallelism" of In, Ru, Ro, Pd, with those elements in the line immediately above, under which they are respectively written, and also of course with the corresponding members of the Iron group on the line yet above. The average difference between corresponding members of the Iron group, and of the Platinum group with In as now written in the table, is about 45, but if we write Zr, Ce, La, and D, under Cr, Mn, Fe, and Co respectively, also Ru, Ro, Pd under Mn, Fe, Co, the "parallelism" of these three lines will be as well preserved as before, the difference of Iron and Platinum groups will then be about 47, In will accord better in "parallelism" than in the table, but Y not so well as there; the difference 47 agrees closely with the average difference between Series C and E, and between E and G in the upper portion of the table. The arrangement adopted in the table however shews best the correspondence of the pairs of elements which have coincident atomic weights in the same group, namely, Co, Ni, and Ce, La, and Ru, Ro; these with Pt, Ir, are the only cases known, and nothing like it is seen in the other or upper portion of the Table. If in connection with this remark, we take the following: that there is no positive pentad, that there is but one positive triad, Bi, (in the middle third of table II,) that therefore all positives are artiads, except the Kalium Group and Bi, and that all these artiads, except the Calcium Group are contained in the lower division of the Table: it will be seen that this lower part is in marked contrast to the upper, and that the scheme of arrangement adopted for the upper is wholly unsuited to the lower.

There now remain only the monad H=1, and the dyad Hg=200, both contained in the middle third of table II, for which I can find no suitable place in either of these schemes of arrangement, and I place them below the last group, and separate them by a line drawn across the table. The first of these is our standard for chemical comparisons having the lowest of atomic weights, which is therefore used as the unit; the other has a high atomic weight, exceeded by those of three elements only, and at ordinary temperatures is the sole liquid metal, and the only liquid element besides Br.

To the Groups in the upper portion of the Table, I have applied names drawn from that member of each group which is contained in series C; several, if not all, are in common use. Under each of these groups we may distinguish two *sub-groups*, and this remark may induce some to accept the arrangement of the Table, who would otherwise be disposed to object to certain portions of it. The Series C, E, G, which contain the greater number of Dumas' "triads" will in every case (except perhaps line—4) furnish the most *prominent* sub-group, to each of which sub-groups except in line —1, may be added an extreme member lying in Series K. The members of the other or *secondary* sub-group, for lines —3 and —2, lie in Series D, F, and column marked H, I; for line —1, they are wholly wanting or missing, but for line +2, they are to be found in Series B, D, F, and for line +1, we may say they lie in the same series, B, D, F, the member in D being missing at present. In Series A line +2, Gl probably belongs to the *secondary* sub-group, while in line +1, Li belongs to the *primary* sub-group, and if Tl properly belong to this sub-group, it will be the largest in the Table, containing five members. The primary sub-group would retain the name of the Group as written in the Table, the secondary sub-groups might be named from their leading members, and we would have for line —3, the Phosphorus and Vanadium sub-groups, for line —2, the Sulphur and Chromium sub-groups, for line +1, the Kalium and Sodium sub-groups, for line +2, the Calcium and Magnesium sub-groups. As the members of each pair of sub-groups are intermingled in the corresponding line of the Table, if it were desired to separate them when each line or Group was under special consideration the secondary group might be written in inverted order, thus :

for line —2, S=32, Se=79, Te=128, Os=199, W=184, Mo=96, Cr=52.5,
for line +2, Ca=40, Sr=87.5, Ba=137, Pb=207, Cd= 112, Zn=65, Mg=24, Gl=9.3,

the atomic weights first increasing successively, culminating in the member belonging to Series K, then diminishing through the members of the secondary group. In the two sub-groups, Cr, Mo, W, and V, Cb, Ta, it is to be remarked that the difference between the second and third members of each group, 88, is almost exactly double the difference between the first and second members. Each of the negative members of series B, namely F, O, N, and C, though closely allied to the primary sub-group of their respective lines, is yet so distinctly marked by several characteristics that they may be regarded as forming in those lines each a *third* sub-group (consisting of a single member,) for which it may be convenient to adopt some distinctive epithet. In the Iron Group we may also distinguish two sub-groups, Cr, Mn, Fe in one, Co, Ni, Cu in the other ; some writers would prefer to interchange Fe and Co. The first of these groups Cr, Mn, Fe, is marked by the power of forming both bases and acids ; by their basic character they are allied to the other members of the same group, and by their acid character they are allied through Cr to S and the Sulphur group, and so an alliance is indicated between the upper and lower portions of the Table, which have been previously shewn in contrast. For these reasons the symbol Cr and its atomic weight is inserted in both portions, and if in Series D, Cr were replaced by Mn or Fe, the atomic weight so introduced would in some respects accord better with the results of the formulæ given above. It may be objected here that the relation between S and Cr used as the ground of alliance between the groups, is exhibited by them not in their dyad but in their hexad character, and then they ought to be placed in line —6 as well as —2 ; so also the relations which induced us to place V in the same group with P, hold between them in their pentad character, and that therefore both ought to be written on line —5 to express this relationship. The objection is, of course, well founded, and will apply to many other cases than these ; and can only be met by maintaining the position already taken in the early part of this paper ; that to obtain the advantages presented by a single table, we must assent to the sacrifice of some of those gained by the use of several tables ; the inverse is also true, that if we desire the advantages given by several tables, we must sacrifice those belonging to a single table, and these are in the present case, compactness and general accuracy in presenting the several groups, and the exhibition at the same time of a remarkable continuity in the sequence of the atomic numbers with striking numerical relations between the Groups and Series.

I will close with two remarks. The first is that the continuity of sequence just mentioned is broken by two notable gaps ; one of 9 successive units from 40 to 50 between the last member of series C and beginning of series D, unfilled by a single number from any part of the Table ; the other much greater, from 137 to 197, an interval of 59 successive units in which only two numbers occur, 182 and 184. The second remark is, that the dyad Hg with its high atomic weight 200, can find a place in the Table only in column H, I, and line +2, where it will be associated with Pb, Ba, &c. To associate it with Pb is not new, but it is not usual to admit it as a member of the Calcium group, and I have not inserted it. If this be permitted or it be regarded as a member of the Magnesian sub-group, then the difference between its atomic weight and that of Cd, namely 88, will be exactly the same as between those of Mo and W, between those of Cb and Ta ; but then what I have called the continuity of sequence will be broken by an inversion, the number 200, exceeding some of those that follow it.

JANUARY 22D, 1885. *

The President in the Chair.

The Chairman stated that the Society had been called together to discuss the practicability of resuming its regular work.

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* From November, 1875, to January, 1885, the operations of the Society were practically suspended. The dark night of political persecution which had settled on the South, with all its attendant evils, the perfect paralysis of Industry in all its departments, the utter prostration of business, the depression of the money-market, the stringency of the times, in a word, the struggle for mere subsistence, all had their influence on the workings of the Society. A large number of its most active and useful members were forced to leave Charleston because of a want of employment and the few who remained were so disheartened and discouraged as to be able to do nothing. But through the persistent and unwearied efforts of the President, (Prof. LEWIS R. GIBBES,) operations were resumed in January 1885.

After lengthy discussion of the subject, on motion of Dr. J. F. M. Geddings it was

Resolved, That the President obtain legal advice as to what steps are necessary to dissolve the Society and close up its affairs.

FEBRUARY 3D, 1885.

The President in the Chair.

The Chairman stated that, in accordance with the resolution adopted at the last meeting, he had consulted Gen. McCrady as to the legality of any action regarding the dissolution of the Society, and, at his request,

Gen. McCrady presented his views of the question.

After a very general discussion it was

Resolved, That it is impracticable and undesirable to attempt to dissolve the Society.

Dr. Geddings exhibited specimens of pyritiferous rock containing a large percentage of Silver, from Kennesaw Mountain.

MARCH 12TH, 1885.

The President in the Chair.

Dr. G. E. MANIGAULT said that he desired to place on record the discovery of two unusual fossils which were obtained from the bed of Wando River near the village of Cainhoy, about 12 miles from Charleston. The first was found by Mr, G. Buist Lucas in 1872, and consists of the last phalanx of one of the toes of the Megalonyx which he presented to the Charleston Museum.

The second is a fragment of the upper jaw of a Dugong with one of the incisors in position. This was presented to the Museum by Mr. G. W. Coxe in 1878. It was shown to Prof. E. Cope in 1880, and, in 1882, at his request, it was delivered to him in Philadelphia for illustration and description. This has since been done but the result has not yet been returned to him from the government printing office at Washington.

These two fossils are interesting, the first, as showing the limit, so far observed, of the Megalonyx in its migrations from its usual habitat in tropical America ; the second, as proving the existence on the Atlantic coast of North America, during a remote geological period, of an animal which at present is confined to the Indian Ocean and to the coasts of Australia.

Members Elected.

Prof. H. E. Shepherd,
Major E. Willis,
Prof. A. R. Guerard,
F. W. Schlepegrell, A. M ,
Dr. C. U. Shepard, Jr.,
Dr. P. G. DeSaussure,
Dr. C. B. Colson,
Mr. C. A. Scanlan.

APRIL 9th, 1885.

The President in the Chair.

Mr. C. A. Scanlan made some remarks concerning the subsidence of the seacoast of South Carolina, suggesting as its probable cause, an underlying stratum of quicksand which is being gradually washed out by the percolation of water seeking an outlet in the ocean.

Dr. C. B. Colson mentioned that he knew several facts which make Mr. Scanlan's theory probable. Many large springs opening into the ocean are known to exist along our coast, they are well known to the fishermen and may be seen on calm days. Do they not carry out sand ? for it is known that a vast quantity is thrown up by our artesian wells, and that these ocean springs are the outlets of the subterranean streams that are tapped by these wells is no longer doubted.

He had had the good fortune to witness how the tides and the direction of the wind affect these wells. At a well 420 feet deep, at West Point Mills, a stand pipe was placed to test the head the well would give, and also test the variation on the different stages of the tide. This well gave a head of 7 feet 3 inches, high water mark being taken for the level.

The variation was exactly 33 inches with the falling and rising of the tide, and was as follows at the different stages of the tide.

The stand pipe was 2 inches in diameter, and the following gauge was taken by float :

High water at 6.20 A. M. at the Bar. West Point Mills on the Ashley.

1878, Nov. 23d, 7 A.M., Gauge fallen 3 inches,
“ 8 “ “ “ 2½ “ = 5½ inches,
“ 9 “ “ “ 6¾ “ =12¼ “
“ 10 “ “ “ 6¾ “ =19 “
Tide now fallen in the river 4 feet 6 inches.
“ 11 A.M., Gauge fallen 6¼ inches, =25¼ inches,
“ 1 P.M., Low water, gauge fallen 7¾ inches, Total, 33 inches.
Wind North West.

An East wind blowing a few days later caused the head to rise and overflow the stand pipe which stood 9 feet some inches, showing conclusively that the direction of the wind does affect these wells.

MAY 14TH, 1885.

The President in the Chair.

Vice-President Frampton exhibited specimens of *Chenopodium anthelmenticum*, in both its fresh and decomposed state, and also a phial of the Ammonia which he had obtained from it, and read the following note of

A Qualitative Analysis of Chenopodium anthelmenticum.

BY LINGARD A. FRAMPTON, M. D.

I BEG leave to call the attention of the Society to a qualitative analysis that I have made of the *Chenopodium anthelmenticum*. It is in my opinion a very interesting plant, nor am I singular in my opinion for it was analyzed many years ago by two distinguished French chemists who were struck with the complex constitution and curious properties which the plant possessed. The name of one of the chemists was Vanquelin, the name of the other I do not remember. The following is the analysis made by these chemists :

1. Ammonia,
2. Carbonate of Ammonia,
3. Phosphate of Magnesia,
4. Phosphate of Lime,
5. Carbon,
6. Vegetable Albumen,
7. Extractive matter,
8. Osmozome,
9. Chlorophyl,
10. Oil of Chenopodium.

In our analysis we detected all the substances found by the other chemists, with the exception of Osmozome. This plant is soon decomposed, with evolution of a large quantity of Ammonia, Sulphide of Ammonia, Sulphuretted Hydrogen, Sulphide of Ammonium and Carbonic Acid gas. These are the gasses evolved by all animal matter in a state of decomposition. The odor of this plant when in its decomposed state is very offensive. It appears that this plant, containing so large a quantity of Ammonia and Nitrogen, and growing, almost everywhere, luxuriantly on the South Atlantic sea coast, might be advantageously used as a fertilizer, since so much strong Ammonia can be obtained by distilling the leaves over Hydrate of Lime, a simple and inexpensive process.

Members Elected.

Mr. D. Ravenel, Gen. D. Kemper.

JUNE 11th, 1885.

The President in the Chair.

Contributions to the Library.

American Philosophical Society, Philadelphia : Transactions, Vol. XXII, part 2, Apl., 1885.

Naturforschenden Gesellschaft, Emden : Jahresberichte, 1884.

Dr. G. E. Manigault exhibited several specimens of *Megathymus Yuccæ*, with examples of the Yucca plant, showing its ravages; also, the Skull of a Chacma Baboon, from South Africa.

The Chairman exhibited a specimen of *Schizandra coccinea*, Michaux, a very rare plant, from Bluffton, S. C.

Dr. Manigault mentioned that the Skull of the Chacma Baboon, *Cynocephalus porcarius*, exhibited by him had belonged to an animal that he had seen alive in the Central Park Menagerie, New York, in October, 1884. It died in the following December and the body was sent to him in Charleston for preparation as a skeleton. Upon examination of the skull after maceration, several teeth were found to be decayed, especially the last molar of the left lower jaw, and the large canine of the upper jaw on the same side was broken off near the socket, leaving the nerve cavity entirely open. The monkey when alive was noticed to be evidently in pain, and this decay of the teeth may explain the condition which was then so apparent to the observer.

Dr. Manigault also mentioned the recent discovery by Mr. A .T. Wayne of the Nest and Eggs of Swainson's Warbler, *Helinaia Swainsonii*, Aud., near Charleston.

Member Elected.

Prof. H. P. Archer.

Correspondent Elected.

Dr. J. H. Mellichamp, Bluffton, S. C.

JULY 9th, 1885.

The President in the Chair.

Contributions to the Library.

Royal Dublin Society: Transactions, Vol. I, Arts. 15--19; Vol. II, Art. 2; Vol. III, Arts. 4--6, and
Proceedings, Vol. 4, parts 5 and 6.

Contribution to the Collection.

Cubes of Sulphuret of Iron, partly converted into Oxide of Iron, from Flat Rock, N. C. *From Dr. L. A. Frampton.*

Letters of resignation were received from Drs. F. Peyre Porcher, S. L. Lockwood and F. L. Parker.

AUGUST 13TH, 1885.

The President in the Chair.

Books Received.

Anales del Museo Nacional de México, Tomo 3, Entr. 6--7, 1885.

American Philosophical Society, Philadelphia: Proceedings. Vol. XXII, No. 118.

The following paper was read:

Swainson's Warbler, Helinaia Swainsoni, Audubon.

BY ARTHUR T. WAYNE.

THIS bird was first discovered by the Rev. John Bachman, in 1832, on the banks of the Edisto River in South Carolina. His experiences with it are quoted by Audubon in his work on the "Birds of America." Dr. Bachman seems to have taken at least five specimens, one of which is in the Charleston Museum and another in the Smithsonian Institution at Washington, this last having been given to Prof. Baird by Audubon himself. Since then only six additional birds were taken, besides the five of Dr. Bachman, until the Spring of 1884, a period of 52 years, at which time it was thought by naturalists to be on the verge of extinction. At the last date, however, believing that its apparent scarcity was due to there not having been any resident collector here for many years during the Summer months, at the suggestion of Mr. Wm. Brewster of Cambridge, Mass., who was here on a collecting tour, I went to work with great earnestness to secure the coveted prize.

After a search of some days in the country a few miles North of Charleston between the Cooper and Ashley Rivers, I secured my first specimen, during a heavy rain storm, on the 22d April, 1884. I was attracted to it by its peculiar song, which was loud, ringing and beautiful. It was also quite ventriloqual, so much so, that I was fully a half hour before being able to locate the precise direction from which the sound came. I thought the bird must have been changing its location as it was singing apparently on the ground, then at some distance off, and then again, on the tree tops. At last, when I caught sight of it, it was sitting quietly on a low bush in the midst of a dense and swampy growth. When killed it proved to be a male. The next specimen procured was by Mr. Brewster a few days after on James Island. His, which was a female, was shot in a dry place, which may be accounted for by the bird having just returned from its Winter journey and not having yet found its favorite haunt. During the Spring and Summer of 1884, I secured over fifty specimens, including the young of the year, and this continued until the 25th September, when it is probable that most of the birds had left for the Winter and only a few stragglers remained.

Swainson's Warbler, as a rule, inhabits the small patches of dense growth which abound along the seaboard of South Carolina. To penetrate these is frequently difficult on account of the climbing vines and abundance of canes. It is also sometimes dangerous, as the poisonous water moccasin has here his favorite abode. I consider the bird by no means abundant, and its favorite haunt makes it difficult to procure. I am unable to specify the exact bounds of its Summer habitat, as I have only searched for it in the region where my first specimen was killed. Mr. Brewster has written a long and accurate account of the bird in "*The Auk*," Vol. II, No. 1.

Having taken Swainson's Warbler in the numbers above stated during the Summer of 1884, and having seen the young that were still unable to fly I felt confident that it bred here, although during that year I never succeeded in finding its nest. As the bird is so strictly terrestrial in its habits the conclusion might naturally be that its nest would be found on the ground. This, however, proves not to be so, and after diligent search I was so fortunate, on the 6th June last, as to find the first nest and eggs that were ever discovered. It was attached to a cane which was one of many that were growing in a pond of water. It was rudely made of dry leaves, principally of the Sweet Gum and Cane, and was lined on the inside with the needles of the Short Leaved Pine (*Pinus mitis*). I waited until I could kill the parent bird upon its nest, so as to be certain of its identity, and found the nest to contain one young just hatched, and two addled eggs. The color of the eggs is a dead white, without markings, and they closely resemble the eggs of the Downy Woodpecker, but have a bluish or greenish tinge which is only perceptible when held in a certain light. This nest and eggs of Swainson's Warbler have been sent to Mr. Wm. Brewster, who has described them in "*Forest and Stream*" of 9th July, 1885.

SEPTEMBER 10TH, 1885.

The President in the Chair.

Books Received.

Boston Society of Natural History: Proceedings, Vol. XXIII, Jan.--March, 1884.

Royal Society, London: Proceedings, Nos. 232--237.

The following paper was read:

THE BLACK WHALE CAPTURED IN CHARLESTON HARBOR January, 1880.

BY G. E. MANIGAULT, M. D.

A FEW words of explanation are necessary as a preface to the following paper on the Black Whale of the middle North Atlantic. The writer gave his notes on the subject to his friend Dr. J. B. Holder of New York City, in the fall of 1882, and a full account of the whale and of its capture was published the following spring in one of the bulletins of the American Museum of Natural History. The Proceedings of the Elliott Society of Science and Art, which is the regular scientific journal of Charleston, were not then being published, and this was the reason for the account having been given to Dr. Holder. Since then however the Elliott Society has resumed its publications, and as the whale was captured here, it seems proper that all the details concerning it should find a permanent place among its proceedings.

THE ATLANTIC RIGHT WHALE, OR BLACK WHALE.

Balæna cisarctica, COPE.
Balæna biscayensis, ESCHRICHT.

Early in the month of January, 1880, a moderate sized Whale was found to have entered the harbor of Charleston, S. C. It moved from place to place in the harbor without ascending either of the rivers emptying into it. It evidently was aware in what direction the sea was, but was unable to find its way out through the narrow opening between Fort Sumter and Sullivan's Island.

On the morning of the fifth or sixth day an attempt was made to harpoon it by a boat's crew from a tug employed in the government works upon the jetties, but the party not being well equipped, and consequently not able to accomplish its capture, decided to come to the city for assistance. The rumor of the intended expedition having spread, at half past one in the afternoon, four steam tugs, between fifty and sixty row boats, and a few sailing craft started in pursuit, the whale heving remained in shoal water near Fort Johnson.

A harpoon was soon lodged in the animal's body from one of the tugs, but this having been found unmanageble, the expedient resorted to was for the tugs to ram the whale with their bows whenever the opportunity offered. The animal was thus worried for some time and also received several lance thrusts from the small boats. It bled considerably and was so much weakened by the various blows and wounds that after an exciting chase of several hours it finally succumbed to its tormentors. During this scene the strength of the whale was exhibited in the lashings of its tail. With a blow from this it knocked a door of one of the tugs off of its hinges, and with its back it raised the bow of another tug clear out of the water. It made repeated efforts to dive, but the water being shallow, the movement appeared to the lookers on, who did not realize its meaning, as an effort to stand on its head.

I did not have the opportunity of examining the animal until the day after its capture, when it was on exhibition. At a glance I saw that it was a Right Whale, as the plates of baleen were visible between the lips of the slightly opened mouth. It measured in length 40 feet 4 inches, and was perfectly black in color over the entire body. Its other important mersurements were, 9 ft. vertically through the thickest part of the body, with 11 ft. width of tail. As soon as the exhibition was over the carcase was given to me for the College Museum, and was towed to a place of safety a few miles above the City. I then proposed to separate the bones from the soft parts without delay, but found the task impossible, and consequently contented myself for the time being with the removal of the baleen, which was drawn out of the mouth on each side in a solid mass, by means of a rope, and cutting out the two eyes which I gave to a medical friend. These were 2¾ inches in diameter, with a very thick sclerotic coat and oval pupils. I was able to satisfy myself without a doubt on this occasion that the animal was a male.

I then allowed six weeks to elapse before visiting the carcase again, and during that time its captors had cut away as much of the blubber as they thought would be worthwhile boiling down. This turned out however not to be a paying operation, for it was not sufficiently thick, and it is probable that the animal having suffured from hunger for several days before its capture, much of its fat had in consequence been consumed in sustaining its life.

The head, ribs and thoracic vertebræ were completely denuded of flesh by this delay, and the other bones were subjected to the ordinary process of maceration in the course of the following six months. The specimen has since been mounted and attached to the ceiling of the main hall of the Charleston Museum.

Its measurements in the flesh and as a skeleton are as follows :

Total length in the flesh, ...	40 ft. 4 inches,
" " " skeleton *	35 " 7 "

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* The difference in length between the animal alive and its skeleton is due to the difficulty of proportioning the intervertebral pads so as to make the two lengths identical.

Length of cranium,	9 ft. 8 inches,
mandible, axially,	8 " 9 "
from muzzle to axilla,	10 " 2 "
of fore limb,	6 " 7 "
Girth in front of fore limb,	22 " 4 "
Space between fore limbs on abdomen,	6 " 5 "
Baleen, longest plates of	4 " 2 "
number of plates on each side,	180
Vertebræ, number,	57
Ribs, pairs,	14
Scapula, height,	21 inches,
breadth,	35½ "
Nasal bones, length,	10½ "
width,	4 "
The first vertebra from the cranium showing the vertical foramen through the diapophysis, is the	38th,
The last vertebra, counting from the cranium, having a neural spine, is the	45th,
The anterior zygapophysis, counting from the cranium, is first definitely separated on the	16th,

The seven cervical vertebræ are united—the posterior four in the lower part of their centra only.

Above the only ones which are united, and thus form a solid crest, are the first six—the seventh or last being entirely separated from the others in every part except the lower centrum.

On the right side the diapophyses of the third, fourth, fifth, and sixth are all united, the first and seventh being separate.

On the left side, the fourth, fifth and sixth are united, the others being separate. The second, third and fourth alone have inferior transverse processes.

The first rib has but one articulating surface, which joins to the transverse process of the first thoracic vertebra. The next eight ribs are joined to the vertebræ by two articulating surfaces, one junction being to the transverse processes and the other to the bodies of the vertebræ. The remaining five, floating ribs, have only one attachment, which is to the bodies of the vertebræ.

During the removal of the various bones from the spot where the carcase had been stranded after the exhibition was over to a place of greater safety, I closely inspected all the work, so that nothing should be left behind. The only bones which are therefore missing and were probably lost are two from the three composing the rudimentary pelvis. I was particularly careful when the bones of the anterior limbs were being removed and had them macerated separately. If the results are the same in other whales of the same age, it must be taken as conclusive that the carpal bones are developed only when the animal is approaching adult years, for there were none in this specimen and but few phalanges.

It appears that this whale belongs to the species which was formerly somewhat abundant off the Atlantic coast of North America, and was the one that was first pursued for its oil and baleen by the New England whalers. It was almost exterminated by them, and then those hardy mariners were forced to extend the limits of their hunting grounds and all the oceans of the globe became the scenes of their exploits. It had never been scientifically described in the early days of its pursuit, and consequently, after a long interval, during which it was slowly increasing in numbers, the attention of naturalists became directed towards its identification. The first description of it as appearing on the American coast was in 1719 by the Hon. Paul Dudley, F. R. S., in the Philosophical Transactions of London, and no other scientific account of it was ever given in America until Prof. Cope of Philadelphia published a short notice in 1865, of a skeleton which has been for many years in the Philadelphia Museum, and which had been stranded near the mouth of the Delaware River early in this century. There are three other well identified specimens in existence in the United States at present. These are an unmounted one in the Museum of Comparative Zoology, Cambridge, Mass., a mounted specimen in the New York Museum, accurately described and illustrated by Dr. J. B. Holder, and the specimen in the Charleston Museum.

Prof. Cope gave the name of *Balæna cisarctica* to the Philadelphia specimen, but the result of the inquiries into its identity which have been the consequence of Prof. Cope's short paper and Dr. Holder's careful investigations, are that the the Black Whale of this coast is now considered to be the same animal as the Biscay Whale, its proper scientific name is therefore *Balæna biscayensis*, this last having been given by Eschricht.

As proof of the difficulties attending the separation into different species of the right whales of the various oceans, it may be mentioned that even Cuvier was uncertain whether there was any difference between the Biscay Whale and the Greenland Whale, and for a long time the former was thought to be identical with the Cape Whale of the Southern oceans. To this day also it seems uncertain whether the Cape Whale is the same as *B. australis*, of which there is a mounted specimen from the coast of New Zealand in one of the courts of the *Jardin des Plantes*, Paris. There can be no doubt however that the four specimens of the Black Whale already specified are entirely distinct from *B. mysticetus* and *B. australis*, as the accompanying woodcuts representing the crania of the three will easily show.

As far as we know of *B. mysticetus* the length of the head is one-third the total length of the body, whereas in the Black Whale the length of the head is about one-fourth the total length. The relative lengths of head and body in *B. australis* are not exactly known to the writer, but the figure 3 is taken from a photograph of the Paris whale and the head there appears to be one-third the total length. The great distances that separate the Greenland from the Antarctic whales are sufficient of themselves to cause the conclusion that they are of distinct species. The plate also of that whale, figure 3, shows many points of difference between it and figure 2, *B. mysticetus.*

In the woodcuts of the three whale heads the total length of body in each one is supposed to be sixty feet, so that the proper porportions of head to body

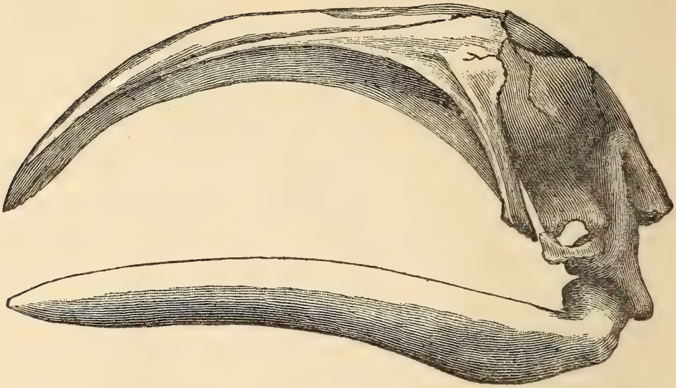


Fig. 1. BLACK, OR BISCAY WHALE.

in each species is represented in the plates. Figure 1 represents the Black or Biscay Whale, Figure 2, the Greenland Whale, and Figure 3, the Antarctic Whale.

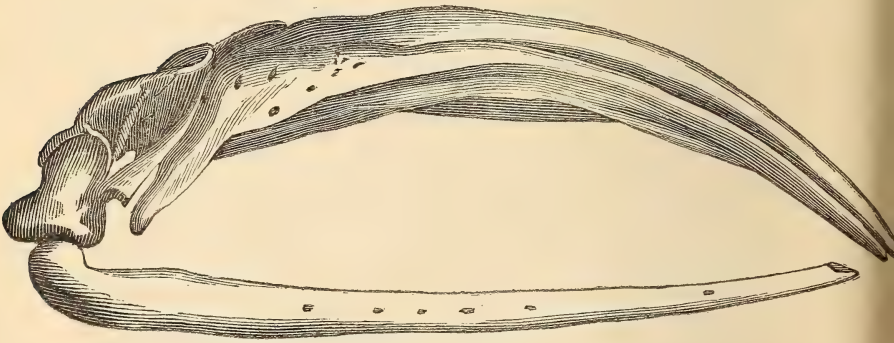


Fig. 2. GREENLAND WHALE.

It is a curious coincidence that the middle North Atlantic whale should have been hunted by the early mariners of both America and Europe, and it was through the skill and hardihood developed by its pursuit that certain of the seafaring populations of both continents became renowned for their whaling voyages. We have already seen how every ocean of the globe became the hunting ground of the New England whalers, after having almost exterminated the coast whale. They were preceeded in this industry however by the seafaring population of Biscay in Spain, who had become so skilled as harpooners that a certain number were always engaged for that particular service in the crews of English whalers when that people were first embarking in the whale fishery.

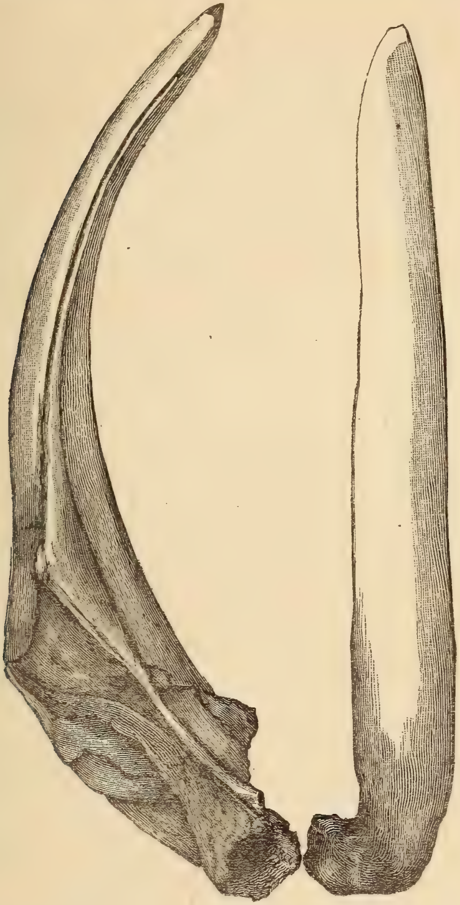


Figure 3. ANTARCTIC WHALE.

There are different localities in the various oceans commonly called *grounds* where whales are more abundant. These are known among the whaling fraternity by certain names. Among them is the Charleston Ground, which comprises that part of the Atlantic between Charleston and the island of Bermuda, with Northern and Southern limits not accurately defined.

There is a lower jaw of a large Sperm whale which was captured in this ground by a New Bedford whaler 50 years ago, and afterwards presented by him to the Charleston Museum. The Biscay whale too has had his home here in some numbers for shortly after the capture of the specimen in this harbor, a large one was cast ashore on Sullivan's Island which had already been stripped of its baleen and blubber. The ground continues to be regularly visited by whalers, although they report the whale as more abundant between the Gulf Stream and Bermuda—the warm water of the Stream appearing to deter them from venturing any distance within its limits. A female, ready to give birth to her young, was secured off the harbor of Port Royal, S. C. in February, 1884, and towed inside, when the operation of cutting up was done at leisure. This specimen was about sixty feet in length, and, although I did not visit it, I feel certain, from descriptions, that it was a *B. biscayensis.* The calf, upon measurement, proved to be 20 feet in length.

It is impossible to even conjecture what the age of the Charleston whale was, but, remembering that the fœtus above mentioned was twenty feet long, there were probably not many years that elapsed between the time of its birth and the time of its reaching a length of 40 feet. The Charleston whale can be considered as having reached two-thirds of its adult growth, and from inquiries made, it does not seem likely that the Black Whale ever exceeds a length of 60 feet.

Mr. MAZYCK mentioned that in a paper on "The Shell-bearing Mollusca of Rhode Island," published in the August number of "*Random Notes on Natural History,*" Mr. Horace B. Carpenter states that the sub-family *Bythininæ* is not represented in America, which is an error, as he possessed an undoubted specimen of *Bythinia tentaculata*, L., from Champlain Canal, near Troy, N. Y., the locality being vouched for by Mr. Thomas Bland, from whom the specimen was received.

Member Elected.

Rev. DAVID LEVY.

Correspondents Elected.

LEVERETT M. LOOMIS, Esq., Chester, S. C.
C. J. HUSKE, Esq., Columbia, S. C.
WM. HEALEY DALL, Esq., Smithsonian Institution.
JOHN PONSONBY, Esq., London.

OCTOBER 8TH, 1885.

The President in the Chair.

Mr. Mazÿck exhibited a very fine specimen of *Murex* (*Phyllonotus*) *spinicostatus*, VAL., from Pawley's Island, S. C., and mentioned the occurence of *Murex pomum*, GM. and *Chione paphia*, L., at the same locality.

Dr. Manigault exhibited mounted specimens of the Emperor Goose and Sabine's Gull, from Alaska.

A letter of resignation was received from Dr. J. F. M. Geddings, and on motion it was

Resolved, That in accepting the resignation of Dr. J. F. M. GEDDINGS as Corresponding Secretary, the ELLIOTT SOCIETY OF SCIENCE AND ART desires to put on record its appreciation of his long and faithful service and its regrets because of the necessity which prompts his severance.

Resolved, That a copy of this Resolution be sent to Dr. GEDDINGS by our Recording Secretary.

Mr. Mazÿck having volunteered to assume the duties of Corresponding Secretary until a successor to Dr. Geddings should be elected, the records of that office were placed in his possession.

Dr. MANIGAULT stated that the Birds exhibited by him had been recently obtained from the Smithsonian Institution. They are both quite rare in collections, and the Institution only parts with those it has when certain other specimens which it desires are offered in exchange. In this case the exchange was consummated by means of Swainson's Warbler, (*Helinaia Swainsoni*, AUD.) the number required having been four. The Goose was valued at $ 20, and the Gull at $ 12, while the Warbler skins were valued at $ 8 each. The Goose and the Gull are both from Alaska, and the Warblers are from the vicinity of Charleston.

Published Oct., 1886.

32d ANNIVERSARY MEETING.

NOVEMBER 12th, 1885.

Officers elected:

President.

LEWIS R. GIBBES.

Vice-Presidents.

J. P. CHAZAL, H. P. ARCHER.

Corresponding Secretary.

F. W. SCHLEPEGRELL.

Recording Secretary and Treasurer.

WM. G. MAZŸCK.

Librarian.

L. A. FRAMPTON.

Curators.

F. W. Schlepegrell,
A. R. Guerard,
G. E. Manigault,
C. F. Panknin,
Wm. G. Mazyck,
L. A. Frampton,
H. E. Shepherd,
C. B. Colson,
C. U. Shepard, Jr.

DECEMBER 10th, 1885.

The President in the Chair.

Books Received.

Museo Nacional de México: Anales, Tomo 3, Entr. 8, 1885.

Dr. C. B. Colson exhibited a specimen of Slag containing unusually large crystals of silicates and imperfectly fused glass.

President Shepherd of The College of Charleston delivered a brief address upon the nature and aims of Comparative Philology. He traced the historical development of the subject, showing the influence that the discovery of Sanskrit exerted in leading to the establishment of unmistakable relations between the ancient dialects of India and the languages of Europe, in other words, to the recognition of the Aryan or Indo-European family of tongues. He then proceeded to illustrate the connection existing between the different languages of the Indo-European family by many examples. showing that an original identity was in a large measure traceable among them. Numerous roots, common to the various languages of the family were cited, and their derivatives were followed in detail. He then gave a concise historical outline of philological deopment in Germany, dwelling upon the special labors of Grimm, Bopp, Pott, Humboldt, Schlegel, *etc.*, in the expansion of the science.

It was shown that comparative philology was in its origin, and in its most complete development, a German science, other nations having, for the most part, appropriated and popularized the researches of German scholars. The origin of speech from monosyllabic roots, the processes of phonetic decay, the fusion of prefixes and suffixes around the roots, were all explained. The importance of phonetics in any scientific study of philology, was then indicated. It was shown that the science of phonetics lies at the basis of any rational study of etymology ; that without it etymology is fairly entitled to the famous judgment pronounced upon it by Voltaire, as "a science in which the consonants signify very little and the vowels nothing at all". Prof. Shepherd then commented upon the necessity of elevating Philology to the dignity of a rational science in our systems of education. An historical acquaintance with language is indispensible to the instructor who has some loftier ideal than mere empiricism, in the teaching of even elementary grammar.

The lack of philological training in the Southern states was deplored, and an appeal made in behalf of a new dispensation in this regard. The origin and evolution of English was then discussed, and its relation to the processes of comparative philology pointed out. It was demonstrated that many familiar idioms are incapable of explanation except by the application of philological methods. Positive and habitual error is the result that follows from the teaching of English, even in our elementary schools, unless the instructor has first acquainted himself with the accepted principles of philological science. In the collegiate instruction, the liability to error is still greater, as the field is more extensive, and the subject increases in difficulty as the student approaches its purely historical phases. The speaker concluded with an earnest appeal in behalf of the philological study of language on the part of teachers in schools of every degree. In the absence of historical and scientific acquaintance with language, empiricism and mechanism is the inevitable sequence.

JANUARY 14TH, 1886.

The President in the Chair.

Books Received.

American Philosophical Society, Philadelphia: Proceedings, Vol. XXIII, No. 121.

Royal Society, London: Proceedings, No. 239.

Dr. MANIGAULT exhibited a mounted skin of a Mourning or Carolina Dove, *Zenaidura Carolinensis*, sent to the Museum of the College of Charleston by Mr. Thomas Ravenel of St. John's, Berkeley. The plumage is largely interspersed with white feathers, the top of the head alone being of the usual color. The rest of the body is so white from the predominance of feathers of that color, that, at first sight, the specimen is commonly mistaken for a domestic pigeon.

It is the first one of the kind he has ever seen and he believes it to be unusually rare. He has therefore considered it proper to place it on record among the Proceedings of the Society. The bird on dissection proved to be a male.

On motion of Dr. Manigault, The Elisha Mitchell Society, of Chapel Hill, N. C., was placed upon the list of the Society's correspondents.

Member Elected.

ELLISON A. SMYTH, JR.

Vice-President Archer called the attention of the Society to the death of Dr. L. A. Frampton, and, in most feeling terms spoke of his long connection with the Society, wherupon, on motion, it was ordered that a page of the minutes be inscribed to his memory.

In Memory of

LINGARD AIKEN FRAMPTON, M. D.,

WHO DIED DECEMBER 21ST, 1885,

AGED 72 YEARS.

ONE OF THE FOUNDERS OF

THE ELLIOTT SOCIETY,

AND FOR THIRTY-TWO YEARS AN ACTIVE MEMBER,

SERVING ACCEPTABLY AS

CURATOR, VICE-PRESIDENT, AND LIBRARIAN.

FEBRUARY 25TH, 1886.

The President in the Chair.

Books Received.

Royal Society, London: Proceedings, No. 240.

California Academy of Natural Sciences: Bulletin No. 4. Jan'y, 1886.

Vice-President Chazal exhibited a most beautiful specimen of Silicified Wood from near the Columbia River, and a specimen of the "Marbre du Chateau Landon", formerly much used for the foundations of buildings near Versailles and Paris, but of which the quarry is said to be exhausted.

Mr. Mazÿck exhibited several beads of colored glass, apparently identical with those found in Indian mounds, which were dredged in Cooper River near the Etiwan Phosphate Works.

The Chairman exhibited several interesting specimens of Slag, showing imperfect crystallization, in comparison with the specimen shown by Dr. Colson at the December meeting.

Mr. Mazÿck reported the progress of the printing of Vol. II of the Society's Proceedings, and mentioned having obtained from the Academy of Natural Sciences, Philadelphia, without cost, and from the Smithsonian Institution, at cost of electrotyping only, cuts for illustration, and, on motion, the thanks of the Society were tendered each institution for its courtesy.

DR. CHAZAL exhibited the photograph of a boy about two years old, the child of respectable and intelligent citizens of Syracuse, New York.

This child was born sometime in August, 1883, with dark brown eyes and dark blonde hair, its parents having also dark brown eyes but dark hair. After a time, not stated, its irises gradually grew paler and, when seen by Dr. Chazal in November, 1884, the age of the child being then 15 months, they presented a uniform velvety surface faintly brownish white, cutting off from the observer's vision every trace of pigment. Pupil black, no apparent anomaly of sight.

The epithelium of the anterior surface of the iris being entire at that early period of life, the velvety appearance was attributed to an epithelial growth.

After this careful but too short examination, no opportunity was offered at that time for another, the child leaving for Florida with its parents, whence it did not return until August, 1885, following, being then about two years old.

Another examination was then made on board the steamer about to leave for New York. The velvety surface had by this time completely disappeared and had given way to one smooth and white, dotted in a radial direction with spots of a duller aspect and as though thinner. But a short line of pigment was visible at the right outer border of each iris. Pupil still black, vision good. The two zones of the iris, internal and external, now distinguishable.

Being then informed by the father that a photograph had been taken of the child in Jacksonville about two weeks before, Dr. Chazal asked for and obtained a copy, that shown to the meeting.

On examining each iris with a good achromatic lens, a cluster of pigment scales is seen at a short distance from the right outer border of either iris, so that in the interval of two weeks the scales had moved close up to the edge.

What had become of the velvety epithelial growth, of nearly all of the pigment scales so abundant in brown eyes (blue and grey eyes being said to have none according to Heule)? Probably washed away or atrophied in part, but Dr. Chazal had not the leisure to look for fragments if such there were.

During the past winter while on a visit to Charleston the father informed Dr. Chazal that the child's irises were apparently getting to be of a light grey color like those of his mother, hence the child's grandmother.

It is much to be regretted that the opportunities for examination were so limited but Dr. Chazal is satisfied that the facts are carefully stated as he witnessed them.

The following paper was read:

THE PROTHONOTARY WARBLER,

Protonotaria citrea, (BODD.) BAIRD.

BY ARTHUR T. WAYNE.

THIS beautiful little bird is an inhabitant of certain gloomy swamps near Charleston, being found in large numbers in Caw-Caw swamp, near the Charleston and Savannah Railroad, twenty-eight miles from Charleston, and in some numbers in the "Nine Mile Bottom" North of the same city. The earliest arrival that has come to my notice was on the 14th April, 1885. On that day I secured the handsomest male that I have ever seen, those of that sex usually arriving the first, as is the case with most birds. It confines itself during the breeding season to the dense swamps along the seaboard of South Carolina, where there is generally an abundance of moisture, and to enter which it is always difficult, on account of the depth of water in many places, and also on account of the treacherous nature of the soil below. The only way to study its habits to advantage in those localities is by means of a light canoe. In this

Page 112, lines 15 and 16, erase the words

so that in the interval of two weeks the scales had moved close up to the edge.

way his paradise can be easily invaded, and then there is no danger of encountering the deadly water mocassin.

During incubation and while rearing their young these Warblers are eminently gregarious, all raising their respective families together in perfect harmony. During this period they appear to confine themselves almost exclusively to the trees that grow in the water, for all those I have shot then have fallen in the water. Afterwards they wander away a little from the swampy growths, and I have shot them then on oaks growing on the high land and even on the ground. They are arboreal birds, however, and it is seldom that I have encountered them otherwise. They do not confine themselves to a particular size of growth like certain other warblers which are never seen except on low bushes, for I have observed them on the top branches of the giants of the forest, on small, thick bushes, and even on logs floating in the water.

The Prothonotary Warbler lays its eggs usually in a hole in a tree, not unfrequently in an excavation previously made by a woodpecker. The number of its eggs is from four to five. They are quite round and boldly blotched with dark brown and red — the shell markings being of a neutral tint upon a whitish ground. They raise two broods during the season, and, if their eggs are removed, they will lay as often as five times. I have known one pair to do this, and every time in the same hole.

The characters of this charming little bird are so well known that it is almost unnecessary to describe them again. The male is of a rich jessamine yellow with bluish wings, and the tail feathers blotched with white. The female is very similar, although a little less brilliant in color. Some males approach a shade of orange, and, singular to say, the fall plumage is brighter than the spring.

The word Prothonotary signifies a Scribe, a Notary, a Judge. The application is quite appropriate, for members of those professions in days long past wore as their official robes long yellow mantles, and the colors of the bird reminded those who first described it of the colors of those garments. This Warbler arrives among us in April, as early as the middle, and leaves again, to winter in the far South, in September.

A letter of resignation from Gen. Del. Kemper was read and accepted.

Mr. Mazÿck exhibited specimens of *Selenites Duranti*, Newc. and *S. caelata*, Mazyck, and read the following description of the latter species:

A NEW LAND SHELL FROM CALIFORNIA.

BY WILLIAM G. MAZŸCK.

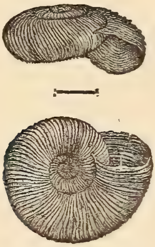
Selenites cælata, Mazyck.

Shell small, depressed, brownish horn-color, with very coarse, rough, crowded, sub-equidistant, irregular ribs, which are obsolete at the apex, and of which there are about 76 on the body whorl ; whorls four, rounded, somewhat inflated below, gradually increasing, the last not descending at the aperture ; suture impressed ; umbilicus wide, clearly exhibiting all of the volutions. Aperture almost circular, slightly oblique ; peristome simple, its ends approaching and joined by a very thin, transparent whitish callus through which the ribs are distinctly seen.

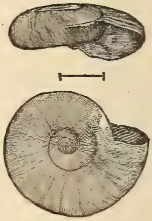
Greater diameter, 4 mm. ; height, 1¾ mm.

Santa Barbara, California, Dr. L. G. Yates.

Hayward's, Alameda County, California, W. H. Dall, United States National Museum,



SELENITES CÆLATA.



SELENITES DURANTI.

This little shell is of about the size of *Selenites Duranti*, Newc., but differs materially from that species in its general outline, being more nearly circular and of greater height, *Duranti* being planulate above with the aperture transversely suboval, while *cælata* is somewhat convex below and has the apex slightly elevated, and its aperture is almost circular. The most marked difference is, however, in the sculpture, *Duranti* being simply coarsely striated while this species is covered, except at the apex, with very heavy rough ribs, presenting somewhat the appearance in this respect of some forms of *Patula alternata*, Say, by which feature it differs utterly from any of its congeners. It is a much thicker shell than *Duranti*.

The above figures of *S. Duranti* were drawn from a specimen received from Mr. W. G. Binney, which agrees absolutely with Newcomb's description and with specimens in the Smithsonian Collection received from him.

MARCH 25th, 1886.

The President in the Chair.

Books Received.

American Philosophical Society, Philadelphia: Proceedings, Vol. XXII, No. 120.

Kaiserliche Akademie der Wissenschaften, Wien: Sitzungsberichte, I Abt., 1884, Heft 6--10; '85, Heft 1--4; II Abt., 1884, Heft 6--10; '85, Heft 1--3; III Abt., 1884, Heft 3--10; '85, Heft 1 und 2; and

Register XI.

Dr. Manigault stated that in the January number of "*The Auk*," a quarterly journal of Ornithology, published in New York, there was an account by Mr. W. Brewster, of Cambridge, Mass., of a visit that he had made to the mountains of Western North Carolina, in May, 1885, in search of the birds of that locality.

The region in question, as well as Northwestern South Carolina and Northern Georgia had never been thoroughly explored ornithologically, and the impression prevailed, without however the result of his visit proving it to be strictly true, that many of the so called Northern birds of North America were in the habit of Summering and breeding there.

The only assertion that can be made with confidence after a careful examination of the various skins collected is "that at least some of the Northern birds inhabiting this elevated Southern region have been more or less modified by the peculiar conditions of their environment. The Solitary Vireos and Juncos are decidedly larger than their Northern representatives; the Robins and Black-Capped Chickadees (*atricapillus*) are apparently smaller. Others again as the Brown Creeper, Golden-crested Kinglet, and Red-bellied Nuthatch, do not differ appreciably."

Mr. Brewster considers himself as warranted in creating two new sub-species after a careful comparison of skins, *viz.*, *Junco hyemalis Carolinensis*, Carolina Junco, and *Vireo solitarius alticola*, Mountain Solitary Vireo.

The first of these differs from *J. hyemalis* in being larger, with lighter, bluer, and more uniform coloration, with a horn colored, instead of pinkish-white or yellowish, bill, while the second differs from *V. solitarius* in being larger, with a stouter bill, and duller, darker, and more uniform coloring above.

Since the publication of these researches Mr. A. T. Wayne of Charleston secured in February, seven miles north of the city, one example of the *Vireo*, which is typical in every respect with Mr. Brewster's series.

Dr. Colson gave notice that, at the next meeting of the Society, he would move that Art. I, Chap.2, of the By-Laws be repealed, thus abolishing the admission fee, and, on motion, this was made the special order for that meeting.

APRIL 22d, 1886.

The President in the Chair.

Books Received.

American Philosophical Society, Philadelphia: Proceedings, Vol. XXIII, No. 122.

Royal Society, London: Proceedings, No. 241.

Academy of Natural Sciences, Philadelphia: Proceedings No.

On motion of Dr. Colson, the special order for this meeting, referring to the abolition of the admission fee, (Art. I, Chap. 2 of the By-Laws,) was called up, and after some discussion, the Article was repealed.

The following paper was read:

Filaria immitis found in a Dog.

BY F. W. SCHLEPEGRELL, A. M.

In February, 1884, a favorite dog, one of the Coach variety, was found lying in a comatose condition, without having shown any previous symptoms of disease. This condition, in the course of a few hours, was succeeded by convulsions and death. The symptoms being somewhat similar to those exhibited in cases of dogs poisoned by strychnia, an examination was instituted which developed the remarkable fact that the right ventricle of the heart was filled with Nematode worms. We counted thirteen in number, ranging from eight to thirty-three centimetres in length.

The presence of such an obstruction in the heart explained fully the symptoms observed and the result, but we were unable to understand how these parasites had found their way into the heart, as we supposed that they belonged to the alimentary canal, and that they could have been in the heart but a short time. Another surprising circumstance was that but few worms were found in the intestines, and those of small size compared to those found in the heart.

Unable to find a satisfactory explanation, we sent a statement of the above facts to Messrs. Munn & Co., Editors of the *Scientific American*, who took great interest in the case, and gave us, in substance, the following particulars :

That our statement was of interest, as, in this country, cases such as we described, are fortunately rare. In China, however, this is not the case. Hundreds and even thousands of dogs die in the same diseased condition. The entozoon, which we described, was doubtless one of the Nematode Blood worms, and not an inhabitant of the intestines. The species so fatal to dogs in China and Japan is often appropriately called the "Cruel Threadworm." It is the *Filaria immitis*. Some writers refer it to *Spiroptera sanguinolenta*, but Cattold says that that species "does not gain access to the blood vessels." Dr. Lamprey says that "the hearts of dogs at Shanghai are invariably found to contain these entozoa." The dogs sometimes die suddenly in a fit, and some linger long in great pain.

They concluded their interesting letter with the statement that the entozoa which we had found were of interest on account of the unusual size attained (33 centimetres) as the usual length was only 10 to 12 centimetres.

Having gained this information, we made a microscopic examination of a female *Filaria immitis*, which we had found in the heart, and found the oviducts crowded with eggs and embryos in all stages of development. We also made a special examination of the blood with one of the higher powers of the microscope, (400 diam.) and found it crowded with the bodies of parasitic animalculæ. In our examination we found only the fully developed worm, which, with the embryos observed in the oviducts of the *Filaria immitis* examined, convinced us that they are reproduced viviparously, and that the young are afterwards carried along in the circulation.

In seeking for the origin of this diseased condition of the dog, we learn that in India, where this disease is most prevalent, it is supposed that the animals may have obtained their parasites from the ova of Ascarides passed by man. It has been asserted that human excrement forms the principle food of dogs in China and India. Presuming the possibilities of the development of the *Filaria immitis* from the ova of the *Ascarides*, this would account for the great prevalence of the disease in those countries.

Dr. Lamprey thinks that the presence of this hæmatozoon is only prejudicial to the canine bearer when the animal is suffering from some other cause, and cites a case where a dog was killed and found to contain over 200,000 of these minute worms, without having previously developed any symtoms of uneasiness. This, however, appears very improbable. In the case, for instance, which came to our notice, the dog evidently died from the effects of the parasitism.

While there is reason to believe that this diseased condition in dogs is not of frequent occurrence in this country, still, we have no doubt, close examination would develop a much greater proprotion than what is usually believed to be the case. The "Dumb Rabies," for instance, a few years ago, was unknown here. It is now found to be a by no means uncommon occurrence. The "Dumb Rabies," while almost invariably fatal to the animal itself, does not endanger the safety of man, as the dog appears to have no inclination to bite, or perhaps no power, as the lower maxilla is drawn downwards in this disease. For this reason, while as common as the violent form of Rabies, it has never been much observed. For the same reason, the diseased condition of dogs, when containing entozoa, has not been generally noticed; and death, when resulting from this cause, has been ascribed to other, or natural, causes.

MAY 20TH, 1886.

The President in the Chair.

Books Received.

Reale Instituto di Studi Superiori Pratici e di Perfezionamento, Firenzi: Archivio della Scuola d'Anatomia Patologica, Tomo I, and Veleni, Sulle Convulsione Epilettiche.
Museo Nacional de México: Anales, Tomo 3, Entr. 9.
Smithsonian Institution: Report, 1884.
Royal Society, London: Proceedings, No. 242.

The Chairman exhibited a specimen of *Heliconia Charitonia,* taken at Beaufort, S. C., being the first specimen yet known to have occurred in this State. Its recorded habitat is Florida and the West Indies.

JUNE 24TH, 1886.

The President in the Chair.

Mr. Schlepegrell exhibited a specimen of Petrified Wood, a fragment of the Jaw of a fossil Saurian, and a fine specimen of a metacarpal bone of a fossil Horse, all from South Carolina.

PRESIDENT SHEPHERD of the College of Charleston, delivered a brief address in which he explained the law of historic development, exhibiting the processes of growth in nations, the rise of similar influences at certain eras, and the combination of events so as to produce great historic results. He endeavored to trace the unity of growth, by several examples, the "reign of law" as illustrated in our complex modern evolution.

That "one increasing purpose" runs through all the ages, is the impressive lesson conveyed by accurate and philosophic study of History.

He selected several epochs, in order to make plain his general proposition, and called attention to the fact that Shakespeare and Gallileo were born in the same year, 1564. Newton was born in the year of Gallileo's death, 1642, the same year that marks the death of Richelieu, the apostle of absolutism, and the beginning of the great struggle in England, in behalf of constitutional freedom. Pope, the highest type of the classical and critical style in our poetry, was born in 1688, the year of the Revolution, which was itself a critical endeavor to fix in precise forms and definite propositions the limits of the constitution.

Newton's Principia, signalizing so great an epoch in modern science, was published in the preceeding year. Goethe, Sir Walter Scott and Cuvier, each a supreme master in his peculiar sphere, all died in 1832, the year of the great Reform Bill.

Many similar cases of historic coincidence were cited, the proximity in time of the invention of printing and the overthrow of the Eastern Roman Empire, as one result of which Greek scholarship was introduced into Europe.

Prof. Shepherd insisted upon the study of History in a purely scientific spirit, and urged the discarding of empirical methods of instruction. as he had already done in regard to the study of Philology.

Members Elected.

Dr. J. L. DAWSON, Jr. Dr. J. J. EDWARDS.

JULY 29TH, 1886.

The President in the Chair.

Books Received.

Royal Dublin Society: Proceedings, Vol IV, Parts 7--9; Vol. V, Parts 1 and 2; and

Transactions, Vol. III. (Series 2.)

Royal Society, London: Proceedings, No. 243.

Naturforschenden Gesellschaft, Emden: Jahresbericht, 1884--5.

Koninklijke Akademie van Wetenschappen, Amsterdam: Verslagen en Mededeelingen, Afd. Naturkunde, III Reeks, Deel 1--2.

Koninklijke Akademie Disciplinarum Neerlandica; Venite ad Me, ad Vergilium, de Alarico.

DR. MANIGAULT remarked that the mammalian bone exhibited by Mr. Schlepegrell at the last meeting of the Society, proves, upon examination, to be a metacarpal bone of the right fore-leg of a horse. The specimen is evidently fossil, is black in color, without any pieces broken off, and was obtained from the phosphate dredgings in Stono River off John's Island, a few miles from the City of Charleston.

Its extreme length is 9¼ inches, and, after comparison with the same bone of a recent horse belonging to a skeleton in the Museum of the College of Charleston, the length of which is 10¼ inches, the following deduction is arrived at, *viz.*, the Museum skeleton being 60 inches high at the shoulder, or, in other words, 15 hands in height, allowing 4 inches to the hand, and the fossil bone being about one-tenth shorter than the recent one, supposing the proportion to be the same between all the other parts of the two skeletons, it would follow that the fossil bone would have belonged to an animal about one-tenth less in height than the recent one, and consequently about 54 inches or 13½ hands.

The existence of bones of two different species of the fossil horse in the post pleiocene of South Carolina has been recognized for many years, and Prof. Joseph Leidy, of Philadelphia, contributed to Prof. Holmes's work on the fossils of South Carolina, a description of certain teeth of the horse found on the banks of the Ashley River near Charleston, which he ascribes to two species, *Equus fraternus* and *E. complicatus.* The first of these was of the size of the average horse of the present, while the other was as large as the London dray horse. The conclusion would, therefore, be that the bone in question, as being of moderate size, belonged to *Equus fraternus.*

A letter of resignation from Rev. D. Levy was read and accepted.

AUGUST 26TH, 1886.

The President in the Chair.

Books Received.

Royal Society, London: Proceedings, Nos. 244 and 246.

SEPTEMBER 23D, 1886.

The President in the Chair.

Books Received.

American Philosophical Society, Philadelphia: Proceedings, Vol. XXIII, No. 123.

California Academy of Natural Sciences: Bulletin, Vol. II, No. 5, September, 1886.

Mr. E. A. Smyth, Jr., exhibited a specimen of *Natica canrena*, L., from Sullivan's Island, S. C., a hitherto unrecorded locality.

Mr. Mazÿck and Dr. Colson exhibited several specimens of Clay and Sand from the Earthquake fissures and salses near the "Ten Mile Hill."

Mr. Mazÿck exhibited a mass of Nests of an unknown insect, (from which the larvæ had escaped,) attached to the stem of *Ampelopsis quinquefolia.*

A Commission, consisting of Prof. L R. Gibbes, as Chairman, and Messrs. W. G. Mazÿck and F. W. Schlepegrell and Drs. G. E.

Manigault and C. B. Colson, was appointed to collect data concerning the Earthquake of August 31st.

The following paper was read:

STERNA FLUVIATILIS AND STERNA FORSTERI.

BY ELLISON A. SMYTH, JR.

In 1831 Swainson and Richardson, in their *Fauna Boreali-Americana*, gave a description of a Tern under the well known name of *Sterna hirundo.* They however, notice some differences from the *S. hirundo* of Linnæus.

In 1834, Nuttall, in a foot-note, calls attention to this Tern and proposes to call it *Sterna forsteri.*

In 1839, Audubon, on Plate 409, fig. 1, of his Ornithology, figures the same bird, in the immature or Winter plumage, however, in which plumage alone that Author seems to have known the bird, as *Sterna havelli.*

To G. N. Lawrence is due the credit of having firmly established the validity of *Sterna forsteri*, by giving complete descriptions and by showing its true relation to *Sterna hirundo*, (or, we should say, *Sterna fluviatilis*, of Nauman, as the American ally of *Sterna hirundo* is now known).

The object of these remarks is merely to bring before the Society some of the easily recognized differences between these two Terns, *viz.: Sterna fluviatilis* and *S. forsteri.*

To the casual observer, in handling the two birds together, *forsteri* will show up as the heavier in every way, and on comparing many examples, this will be found pretty constant.

The bill in *forsteri* will be found a little longer and noticeably heavier at the base. Even young specimens of *fluviatilis*, in which stage the bill is generally deeper than in the adult, scarcely, if ever, approach the full depth observed in *forsteri.* The bill of *fluviatilis* will always show slighter proportions.

In the adult *fluviatilis* the bill is coral at the base, gradually deepening into black, and with a yellowish tip; the young of the same species has only a trace of yellowish near the base of the bill, and the rest of it is black, thus being very like the bill of *forsteri*, but here the size is a guide, *forsteri* being stouter. This change in the bill of *fluviatilis* is exactly a counterpart of what occurs in *S. superciliaris*, (Least Tern).

The leaden color of the belly plumage of *Sterna fluviatilis*, in full plumage, will easily distinguish it from *forsteri* at the season when both have the black of the pileum complete; and though the white breast and belly plumage shown by most Fall and Winter specimens of *fluviatilis* is like that of *forsteri*, the pileum will be a guide; that of *forsteri*, with the exception of a black bar through the eye, almost disappears, or seems as though hidden under a layer of whitewash, while *Sterna fluviatilis* only whitens a little on the forehead and retains the black on the posterior portion of the pileum unimpaired.

Without amplifying more, let us look at the most noticeable feature : namely the tail. Taking age for age, and making all allowances for condition of moult, *forsteri* will average longer in the tail and more deeply in the fork than *fluviatilis*, thus coming nearer to the length of tail shown by *Sterna macroura*, (The Arctic Tern).

But the constant feature, and one that will serve to mark the birds when all others fail, is, that in *forsteri*, the outer tail feather, and most of the others, have the *outer web pure white*, and the inner web dark ; while *fluviatilis* has the *outer web dark* and the inner web pure white.

These differences are constant in any plumage.

The eggs of *forsteri* will average darker than those of *fluviatilis*, besides being different in shape and style of marking. It is hard to describe these in words, but to the eye the differences are apparent at a glance.

It is only necessary to say that the pure coral beak of *Sterna macroura*, (Arctic Tern,) the lower plumage and mantle being unicolor, and the longer and more graceful sweep of tail, will at once distinguish it from *fluviatilis* or the European *hirundo*, while the rosy breast, attenuated bill, and extremely long, white, almost filamentous tail of *Sterna dougalli*, (Roseate Tern,) mark it as free from any near ally. In fact *S. dougalli* represents the maximum tail among the *Sterninæ*.

S. forsteri is our most common Winter Tern, and the one usually seen flying in the Harbor and among the wharves, in company with *Larus philadelphica* and *L. delawarensis.*

OCTOBER 28TH, 1886.

The President in the Chair.

Mr. Smyth read the following

Note on Sitta canadensis.

BY ELLISON A. SMYTH, JR.

On the 4th of October, 1886, while collecting in Clarendon County, in a thick swamp not far from the Santee River, I observed a small bird fluttering and hopping, after the manner of a *Dendrœca*, about the terminal branches near the top of a large Tupelo or Black Gum tree. The distance from the ground was such that I could not recognize the bird, but a peculiar darkness about the head made me desirous of obtaining the specimen, for I could not place it among any of the Warblers that I thought likely to be met with. I shot the bird and to my surprise found it to be a fine male specimen of the Red-bellied Nuthatch, (*Sitta canadensis*).

I can find no *direct* quotation of any previous capture of this species in South Carolina.

Audubon says "Southern limits seldom farther than Maryland * * * some at the approach of Winter venture as far as South Carolina, altho' *never seen in the maritime districts of that State.*"

Coues says "North America at large, in wooded regions, but rather Northerly (to 60° or farther). South, however, to the Mexican Border. * * * * *apparently wanting* in the *Southern States,* its place being supplied by the peculiar *Sitta pusilla,* along with *Sitta carolinensis.*"

Unless I am mistaken, this will prove the first occurrence of *Sitta canadensis,* certainly so near the seaboard, in South Carolina. This capture was consequent upon a very cool change.

The Chairman read an incomplete report of his obsevations upon Earthquakes occurring in South Carolina in the last half century.

Members Elected.

Dr. JOHN GUITÉRAS, Dr. CHAS. W. KOLLOCK.

33D ANNIVERSARY MEETING.

NOVEMBER 25TH, 1886.

The President in the Chair.

Books Received.

Boston Society of Natural History: Memoirs, Vol. III, Nos. 11--12; and

Proceedings, Vol. XXIII, Part 2.

Smithsonian Institution: Report, 1884, Part II.

Royal Society, London: Proceedings, No. 245.

Naturwissenschaftlichen Gesellschaft, Isis, Dresden: Sitszungsbericht, 1885.

Kongelige Norske Frederiks Universitetet, Christiania: A. Helland, Lakis Kratere og Lavastromme; and

F. C. Schübeln, Norges Vaextrige et Bidrag til Nord-Europas Natur og Culturhistorie, Vol. I.

The following Officers were elected to serve for the ensuing year:

President.

LEWIS R. GIBBES

Vice-Presidents.

J. P. CHAZAL, H. P. ARCHER.

Corresponding Secretary.

F. W. SCHLEPEGRELL.

Recording Secretary and Treasurer.

WM. G. MAZŸCK.

Librarian.

G. E. MANIGAULT.

Curators.

F. W Schlepegrell,
G. E. Manigault,
C. F. Panknin,
C. U. Shepard,
J. Guitéras,
Wm. G. Mazyck,
H. E. Shepherd,
C. B. Colson,
E. A. Smyth, Jr.,
J. J. Edwards.

The following paper was read:

The Identity of the Comets 1886 *b*, 1844 *b*, and 1678.

By LEWIS R. GIBBES, M. D., Professor of Astronomy in the College of Charleston, S. C.

THE number of *Nature* for 14th October last, mentions the discovery of a Comet on 26th September, by Mr. Finlay, of the Cape of Good Hope Observatory, and gives the Elements of its parabolic orbit, as calculated by Dr. Holetschek, which we copy in the table below. The remark is added, that "it appears to be probably identical with Comet 1844 *b*," but the writer omitted to add that Comet 1844 *b* is almost certainly identical with the Comet of Aug., 1678.

In Oct., 1844, I received from Mr. Sears C. Walker of Philadelphia, a slip from the *Philadelphia Gazette*, announcing the discovery of a Comet, on the 10th of that month, by Mr. Hamilton L. Smith, of Cleveland, Ohio, and containing Smith's observed places of the Comet, from the 10th to the 22d, when the brightness of the moon rendered it invisible. From these observations I calculated the Elements of its Parabolic Orbit and published them in the *Charleston Mercury* of Oct. 18th of same year, at the same time pointing out their similarity to those of the Comet of 1678, and saying that "I feel confident that the Comet of Aug., 1678, and the Comet of Aug., 1844, are one and the same," with a revolution of 166 years or of some aliquot part of that number, if it should have been unobserved at some intermediate return to the Sun.

In a week or two the news arrived from Europe, that the Comet was first discovered by DeVico, at Rome, Italy, on the 22d Aug., nineteen days before Mr. Smith, and hence has always been called DeVico's Comet. Several parabolic orbits were obtained by different calculators, and the elements of DeVico's orbit (as given in Encke's edition of Olber's *Abhandlung*,) differ but little from my own, except in the Longitude of the Perihelion, which is greater than mine by 10°, and consequently his date of Perihelion passage is ten days later than mine ; he doubtless had a longer arc at his command, as his first observation was nearly three weeks earlier than Smith's. It is unnecessary to give either his orbit or mine, as they were soon entirely superseded, by more accurate results derived from a still more extended arc of the Comet's orbit, for it was presently found, that a parabolic orbit would not satisfy the observations made as the Comet travelled onwards in its path.

Several elliptic orbits were then computed, agreeing closely with each other, and giving a periodic time for the Comet of about five and a half years, a shorter period than any Comet then known except Encke's, and each of these short period comets is found to move *direct*, that is, in the same direction as the Earth around the Sun. In these elliptic orbits, the Inclination and Perihelion distance are less, and the Longitude of Node is greater than in the parabolic orbits. The Longitude of Perihelion is also greater and therefore the time of Perihelion passage is later ; of these we give Brünnow's orbit in the adjoining table.

Table of Elements of Orbits of Comets of 1678, 1844, *and* 1886.

DATE,	M. TIME GREENWICH.	PERIH. LON.	PERIH. DIST.	INCL'N	ASCEND'G NODE LONG.	ECC'TRY	CALCULAT'R
1678, Aug. 18	7½ hours	322°48′	1.1453	2° 52′	163° 20′	0.62697	LeVerrier.
1844, Sep. 2	11⅓ "	342°31′	1.1864	2° 55′	63° 49′	0.61765	Brünnow.
1886, Nov. 22	17¼ "	347°50′	1.2240	3° 23′	48° 36′	Not given	Holetschek
Motion of each was Direct.							

It will be seen from this Table that, the Node has been rapidly retrograding, nearly 3° at each revolution, the Perihelion advancing at a nearly uniform rate of 40′ at each revolution, that the Perihelion Distance and Inclination are slowly increasing, and that the Eccentricity is diminishing. Until some change in the character of the perturbations takes place it will become less and less conspicuous at each observed return. The Aphelion Distance is not explicitly given by the calculators, but can easily be obtained from the Table, does not differ much from 5, and appears to be nearly the same in 1844 that it was in 1678, so that the major axis has increased by nearly the amount of increase of the perihelion distance ; the periodic time must therefore be slowly increasing. The orbit therefore lies wholly within the orbit of Jupiter, and their aphelia lie not far from each other.

The similarity of the orbit-elements of this Comet to those of the Comet of 1678, has of course been perceived by others as well as myself, and LeVerrier made them the subject of special investigation in his researches on periodic Comets, and he gave, in the *Comptes Rendus* of 20th Dec., 1847, as the result of his studies, this conclusion : "that as far as can be judged, the Comets of 1678 and 1844 are identical." It is doubtful whether any stronger affirmation than this can ever be given, as LaHire's observations lack precision ; they seem not to be the result of measurements, but of eye-estimates of the Comet's position among the neighboring stars. See Lemonnier, *Histoire Celeste,* p. 238, and Pingre', *Cometographie,* ii, p. 24. The elements of the elliptic orbit of the Comet of 1678, with a periodic time of 5⅜ years, as calculated by LeVerrier, we give in the adjacent Table for comparison with those of the Comet of 1844. The differences between the corresponding pairs of elements, according to the calculations of LeVerrier, are caused by the attraction of the planet Jupiter.

With a period so short as 5⅜ years, there must have been numerous returns, between these three recorded appearances. If we assume 8 periods in the interval 1844—1886, which is 42,2-9 years, we get an average period of 5.28 years; and if we assume 32 periods in the interval 1678—1844, which is 166,1-24 years, we get an average period of 5.19 years; which results agree with the increase in length of period already remarked. If we assume 33 periods, we would get an average period of 5.00 years. I have not heard that it has ever been observed at any of these intermediate returns. It is a telescopic Comet, with perihelion distance greater than the Earth's mean distance from the Sun by at least 1-7th ; it is barely visible to the unaided eye when nearest the Earth, and can be best observed when it comes to its perihelion about the middle of September. If it comes to its perihelion a couple of months before or after this date, it will less easily be observed.

The *parabolic* orbit of Comet 1886*b*, is inserted in the Table, as I have seen no notice of any *elliptic* orbit yet calculated. The number of *Nature* for 21st Oct. contains none, and that for 28th Oct. has not yet reached me ; they arrive frequently three or four weeks after date.

DECEMBER 23D, 1886.

The President in the Chair.

The following paper was read :

On the probable source of the Phosphorus in the South Carolina Phosphates.

BY G. E. MANIGUALT, M. D.

THE deposits of a rock known as Phosphate of Lime, an important ingredient, when ground to powder, of the commercial fertilizers which are largely used at present in agriculture, occur over a wide range of country along the seaboard of the South Atlantic, reaching from North Carolina to Florida. They are confined mainly to the coast, but extend in a few instances to a distance of sixty miles inland. The centre of the deposits is in South Carolina, between the cities of Charleston and Beaufort, and it is there only that its mining is profitable, as, out of that area, the rock is either not favorably situated for economical handling, or does not contain a sufficiently high percentage of phosphate of lime to be advantageously worked.

The question as to the source from whence came the phosphorus which united with the lime to form this combination, has been a puzzling one. Several theories have been advanced, which are as follows : The first, which originated with the elder Prof. C. U. Shepard, assumes that the fragments of marl were charged with the sweepings from guano beds, formed above them by the congregation there, at some indefinite time in the past, of vast flocks of birds.

A second theory, which was advanced by Prof. F. S. Holmes, maintains that, at a remote geological period, before the extension of the coast line to its present limits, there existed lagoons of salt water at some little distance from the ocean, which were visited by vast herds of animals from the interior country, such as the mastodon, elephant, bison, etc., just as animals assemble now about the salt-licks of Kentucky, to obtain the salt which is essential to their existence, and that, in this way, the nodules, which had been left upon the recession of the sea, became charged with the phosphoric acid contained in their excrements and remains.

A third explanation of the formation of these rocks is that "certain mollusks possess the power of separating the phosphate of lime from sea water, and that, through their instrumentality, the marl, and especially the upper strata, became charged with a certain amount of phosphate of lime. That the proportion of the phosphate of lime thus obtained to the whole body of the superficial layers of the marl was afterwards increased. 1st, By the removal of a considerable amount of the carbonate of lime, rendered soluble by the percolation through it of rain water containing carbonic acid, derived from the decomposing vegetable matters in the soil overlying the marl. 2d, By a well known proneness of phosphoric acid, when diffusely distributed, to concentrate and to give rise to concretionary processes, similar to those observed in the flint nodules and pebbles of the English chalk. This theory agrees with the diffused occurrence of phosphate of lime in the superficial layers of the marl, as well as with the fact that the upper layers of the deposits and the outside of the nodules are the richest in phosphate. It substitutes for a local cause a general one, commensurate at once with the wide area occupied by the phosphate rocks, and by the phosphatic marls of the South Atlantic seaboard. Such a cause might have been in operation ages ago, when the layers of phosphate rock, found at a depth of 300 ft. in artesian borings, were forming: and it may be in operation now, as the dredging work of the United States Coast Survey shows that the marls accumulated at the depth of 200 fathoms, on the floor of the Gulf Stream, between Florida and Cuba, contain a considerable percentage of phosphate of lime." *

There is plausibility in each of these theories, and it is not the purpose of the writer to attempt to disprove them. His object in this paper is to advance another theory which he thinks is entitled to consideration.

It is, that the phosphorus contained in the phosphate rock was derived from the decomposing bodies of a great number of immense sharks, whose extinction was sudden and general, and due to the cold of the glacial period.

It must be explained here that the phosphate rock in question is of two kinds,—the land and the river rock. The first is found at a depth of from 2 to 10 feet below the surface of the soil, and is usually in masses or nodules, vary-

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* Resources and Population of South Carolina, by Agricultural Department of the State, 1883, page 49.

Published May, 1887.

ing from the size of a potato to several feet in diameter. The other or river rock is generally found in a layer or sheet of tightly compacted nodules, overlying the marl at the bottom of rivers and creeks, where it either forms the bottom itself, or is overlaid by a deposit of mud of greater or less depth.

The difference between the compacted mass of river rock and the detached nodules of land rock can be accounted for by remembering that the coast belt of South Carolina, inside of the sea islands, and for some distance in the interior, has been formed by alluvial deposits on the banks of the rivers, with sandy spaces between, which have been accumulated by the action of the ocean, and overlying in most places a stratum of clay of varying depth and thickness. In these sandy spaces the nodules are mined, and, besides being in many cases evidently waterworn, the manner in which they lie is proof that they have been subjected to the operation of waves and currents, previous to having been covered by the accretions from the ocean. Thus their origin is probably the same as the river rock, from which they became broken off and moved to a short distance inland.

There are interspersed among the nodules of land rock, the mammalian bones of the mastodon, elephant, bison, tapir, deer, fossil horse and domestic cow and hog, also of one of the larger Cervidæ, and certain cetacean bones. Of fish bones there are a few vertebra of sharks and other fishes, and many shark's teeth. Lying upon the surface of the river rock are also the same mammalian bones, with the addition of those of the walrus, dugong, manatee, mylodon, megatherium, and cetacean bones in large numbers ; also a few reptilian vertebræ which have never been identified, while, embedded in its mass, are a vast multitude of shark's teeth and a few of their vertebræ.

There is that marked difference between these two kinds of bones, the mammalian and the fish, that, within the writer's observation, he has never seen an instance of a mammalian bone being embedded and held fast in the rock, either land or river, while he has in his possession several specimens where both the teeth and the vertebræ of sharks and other fishes are held in the rock.

The inference which he thinks can be legitimately deduced from this is, that the formation of the phosphate deposit was contemporaneous with the partial extinction in these waters of the shark family of fishes. This may have been anterior to the existence here of the other classes of vertebrates. The question however is unimportant, as, from the deposit having been formed under water, fishes alone can be considered as having contributed to its formation.

It is well known that the great store house of phosphorus is the earthy matter of bone, and here it may be objected that the skeletons of sharks being largely cartilaginous, their bodies would have been incapable of supplying the amount of phosphorus required. The reply to which is that, supposing the same conditions to have existed in fossil sharks as prevail in the modern shark, where the only parts of the skeleton that cannot be preserved on account of their softness are the skull, ribs and fins, there still remained the jaws and vertebral column, the latter of which in modern sharks contains almost the usual proportion of earthy matter as in mammals. In estimating then the probable volume of the bones of the column in a large fossil shark by an inspection of the same part in a whale 60 feet long, it becomes easy to understand that that part of the body must have consisted of large bony masses, as it does in the whale ; these were essential to the great muscular power and vigorous movements that doubtless characterized the fossil animal as they do the recent one. Solidity of the vertebral column, the consequence of about the usual proportion of earthy matter in its bones as in the bones of mammalia, must necessarily have been a marked feature of those shark skeletons.

There are very few of these vertebræ remaining in the phosphate beds, and the presumption is that they have been absorbed in the mass, imparting thus to the lime one of their most important constituents, namely phosphorus. The quantity of teeth however, especially in the river rock, is very great ; but, large as their number is, they do not give an adequate idea of the mass of flesh and bone to which they belonged, until the immense size of the sharks of that period is taken into account. The reason of the teeth not having been absorbed like the bones lies in the enameled surfaces with which they are coated, and which protected them from external influences. To judge of the immense bulk of one of these sharks the outlines of two teeth are here appended.* The large one is of an unusually large specimen of *Carcharodon megalodon*, and the small one of a recent shark, *Carcharias vulgaris*, of the same family, 8 ft. in length. If the same relative proportion of tooth to body existed in the fossil sharks as prevail in the recent, they must have reached a length of from 70 to 80 ft. and even more.

It should be understood that in this opinion as to the source from whence came the phosphorus, the mammalian bones are in no way considered as a source of supply. Their existence in the rivers of the phosphate region is by no means unusual, and it is probable that if the same industry existed elsewhere, of searching the bottoms of rivers for phosphate rock, or other substances of commercial value, the same interesting remains would also be found. As it is, the most perfect bones and teeth of extinct mammalia have been found in certain rivers in South Carolina outside of the limits of the most productive beds.

It becomes necessary, in further explaining the probable cause of this sudden and large extinction of fish life, to allude to a phenomenon which has for some time been apparent to paleontologists in their investigations into the extinct fauna of Europe and North America. This consists of an evident sudden extermination, at a remote period, of a vast amount of animal life in both hemispheres. The observations have been made principally as to mammalian life, and the writer is not aware that similar observations have been yet made of the same phenomenon as evidenced in the phosphate beds of South Carolina. There is no reason however for doubting that the same cause, which is believed to have produced this rapid destruction of animals in the Northern parts of both hemispheres, operated with equally fatal results as far South as the 32° of latitude, upon a class of animal life peculiarly susceptible to cold.

There has been no general agreement among the scientific as to the way in which the glacial period manifested itself. Of the many opinions advanced, the one that would be the most applicable to the conditions under consideration, would be the passage of large icebergs along the South Atlantic border. This phase of the glacial period has been thought probable by some, and there need be no further doubt as to the presence here at one period of the cold of the Arctic regions, when it is remembered that the bones of the Walrus are among those that have been found.

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* Plate 1.

The Chairman read a second part of his report upon the Earthquake. *

JANUARY 27TH, 1887.

The President in the Chair.

Books Received.

American Philosophical Society, Philadelphia: Proceedings, Vol. XXIII, No. 124.

Royal Society, London: Proceedings, No. 247.

Museum of Comparative Zoology, Cambridge; Bulletin, Vol. XIII, No. 1; and

Report of the Curator, 1886.

Museo Nacional de México: Anales, Tomo 3, Entr. 10.

Lend a Hand, (Magazine,) Vol. II, No. 1.

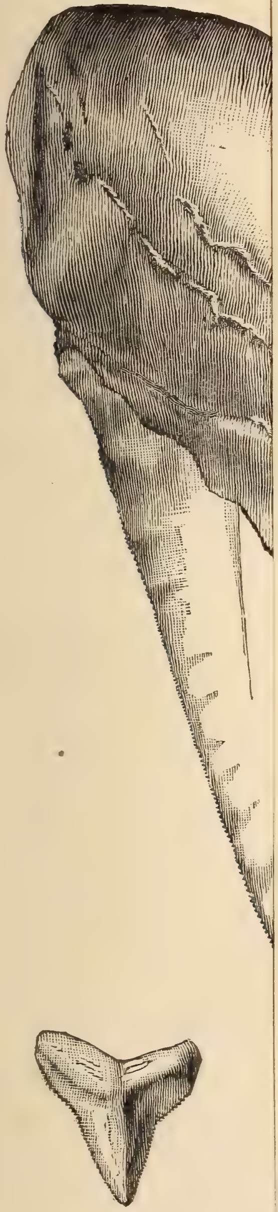
The Chairman made a verbal communication concerning his observations of the effects of the Earthquake in the various Cemeteries in and near the City.

Mr. Mazÿck read the notes on the Earthquake which he had prepared for the use of the Commission appointed at the September meeting. *

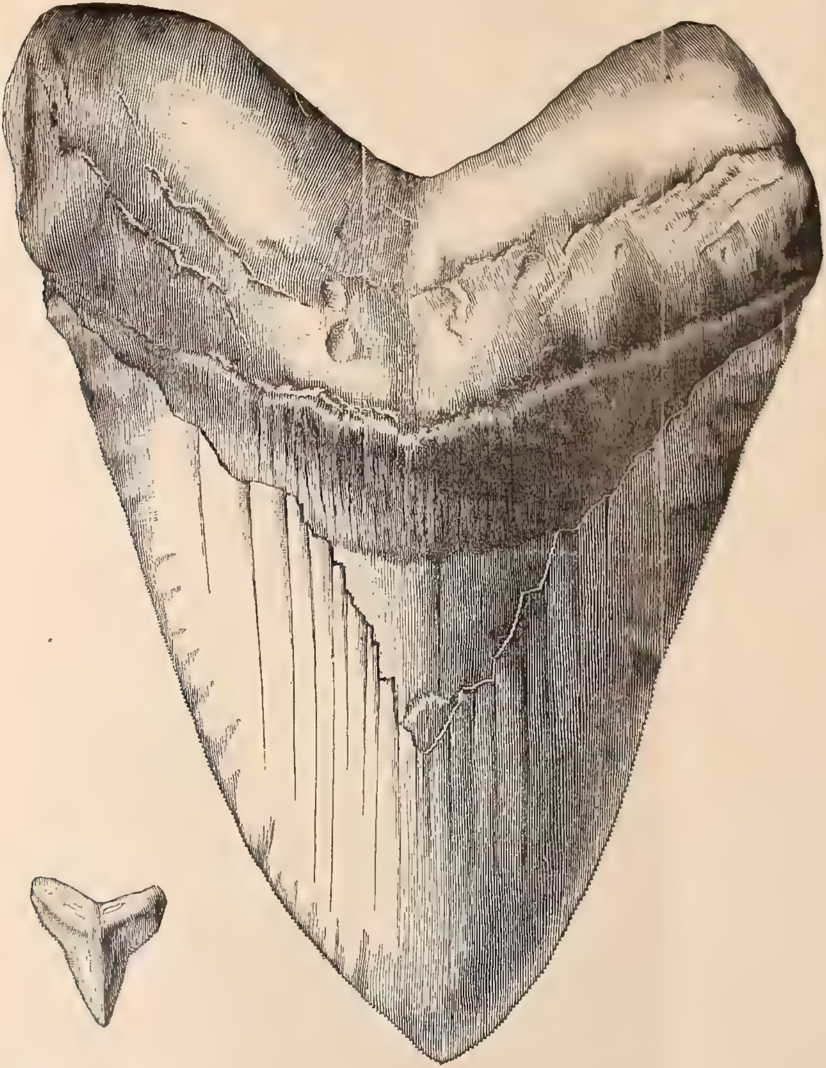
Member Elected.

Dr. R. BARNWELL RHETT.

* Referred to the Commission appointed Sept. 23d, 1886.



CARCHARIAS VULGARIS.



CARCHARIAS VULGARIS. CARCHARODON MEGALODON.

FEBRUARY 24th, 1887.

The President in the Chair.

The Chairman continued the reading of his observations upon the Earthquake.*

MARCH 24th, 1887.

The President in the Chair.

Books Received.

Royal Society, London: Proceedings, Nos. 248--251.

Connecticut Academy of Arts and Sciences: Transactions, Vol. VII, Part 1.

Elisha Mitchell Scientific Society, Chapel Hill, N. C.: Journal, 1885--6.

Imperial University of Japan, Tokio: Memoirs of the Literature College, No. 1.

Kaiserliche Leopoldina Carolina Deutsche Akademie der Naturforscher, Halle: F. W. Klatt, Beiträge zur Kenntniss der Compositen;

Fr. Ratzel, Zur Kritik der sogenannten "Schneegrenze";

F. E. Gernitz, Eine neue Hypothese der Gebirgsbildung;

———— Die Endmoränen (Geschiebestreifen) in Mecklenburg;

J. Schnauss, Photographie bei Nacht;

———— Ueber die Farbenempfindlichkeit der Photographischen Schicht; and

G. Engelhardt, Tertiäre Pflanzenreste von Waltsch.

Museum of Comparative Zoology, Cambridge; Bulletin, Vol. XIII, No. 2.

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* Referred to the Commission appointed Sept. 23d, 1886.

Kaiserliche Akademie der Wissenschaften, Wien: Sitzungsberichte, 1885, I Abt., Heft 5--10; II Abt., Heft 4--10; III Abt., Heft 3, 5--8, 10. '86, I Abt., Heft 1--2; II Abt., Heft 1--2; and Almanach, 1886.

The Chairman continued the reading of his observations upon the Earthquake.*

Mr. F. W. Schlepegrell read a paper on "Some Electrical Disturbances during the Earthquake."*

Dr. MANIGAULT having recently returned from a visit to Washington, where he met several of the officers of the Geological Survey, stated verbally, that Captain C. E. Dutton informed him that the results of the investigations of Mr. Sloan, who was commissioned to make observations upon the earthquake phenomena at Charleston, Summerville, and the country around, were that three *loci* of vertical movements or thrusts were now considered as having been clearly defined in the area severely affected.

The first was between Mount Holly Station on the North Eastern R. R. and Ladson's on the S. C. Railway — the second was on both sides of the Ashley River in the neighborhood of Middleton Place, and the third at Rantowles' on the Stono River, about ten miles from Charleston. The surface waves which spread from these three centres where the thrusts were vertical may have been the cause of the contradictory opinions as to the direction from which the shocks came, and it is also possible that, as the waves reached the harbor, the sounds parted from the wave movement and reverberated from the opposite shores, thus producing absolute confusion as to direction.

Dr. Manigault expressed the opinion that the greatest injury done to the lower part of the City was by wave movement exclusively, which caused every kind of building to sway or rock backwards and forwards, including the steeples of churches, and that, although there may have been destructive waves from all three of the *loci*, causing contradictory opinions in some few cases, the most destructive waves to buildings South of a line running East and West through Cumberland St., were from the Westward. He mentioned several buildings as evidences of this direction from which the force came, especially the porch of the Medical College, the porches of the Hibernian Hall, St. Michael's Church, South Carolina Hall and Scotch Presbyterian Church.

His reasons for being of this opinion were that the earthwaves which passed under his feet while standing in his garden, before the great shock was over, moved towards three brick houses in Legare St., numbers 8, 10, and 12, and it is therefore natural to conclude that the waves which he felt were the same that did the damage to those three houses. The direction of those waves was from a point known as the opening of Wappoo Cut, on the Western bank of Ashley River, a trifle South of West from the spot where he stood, and going towards a little North of East.

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* Referred to the Commission appointed Sept. 23d, 1886.

The central of those three houses, the No. 10, was the one the most damaged, and all three had their Eastern ends — the ends farthest away from the direction of the waves, the worst shattered.

The waves reaching these houses from the West and producing the rocking or swaying motion, did not damage the Western ends as much as the Eastern, because the side walls gave support to the former as the waves passed underneath, and there was nothing beyond the latter, in the shape of supporting walls, to give them the steadiness which the first had received. Another proof that the Eastern end of the No. 10 dwelling was more shaken than the Western was that, of three chimnies on the South front, projecting above the roof, the Easternmost was the only one broken off, having been the most shaken on account of its proximity to the Eastern wall.

These inanimate evidences of the directions of the surface waves are more reliable than the impressions made by sounds and sensations. They seem to explain why the Western column of the porch of the Medical College, facing South, remained standing, while the other three fell — why the entire porch of Hibernian Hall, facing East, became a complete wreck, and why the porches of St. Michael's Church and South Carolina Hall remained standing. Those two buildings, facing West, sustained their porches as the waves from the West pressed them in an Easterly direction. The porch of the Scotch Presbyterian Church faces East, and, according to this rule, should have fallen also. But the pediment above is of light material, and not of heavy masonry as that of the Hibernian Hall was. It is also supported at each end by being joined to the towers, which contributed to their ability to stand and to their thus surviving the shock. The Church proper was extremely shaken and the destructive character of the waves was better illustrated in this case than in most others, as the masonry was of the very best quality.

It is more than probable and, indeed, it has been already observed, that surface earth waves do not radiate from locations of vertical thrusts with equal intensity in every direction. Those which prove destructive to human habitations lying in their track follow certain directions on the earth's surface favorable to their progress, while others are weakened by the inert resistance offered by the immobile earth, and very many are entirely arrested and set at defiance by the absolute impossibility of any forward movement. It is only by taking this into consideration that the escape of certain brick houses, not built of the most substantial masonry, can be accounted for, while, in the immediate neighborhood there might have been an other construction, like the Scotch Presbyterian Church, for example, which, model as it was of the best kind of brick work, was forced to yield to the violence of the waves.

In view of this explanation and the certainty that there were three locations where vertical thrusts predominated, it would seem likely that the Stono River and Wappoo Cut, which communicates with it, were the favorable track by which the earth waves radiating from Rantowles' as a centre, obtained access to the harbor, and caused the destruction which occurred in the lower part of the City.

Mr. E. A. Smyth, Jr., mentioned the recent re-discovery of Bachman's Warbler in Louisiana.

MAY 26TH, 1887.

The President in the Chair.

Books Received.

Journal of Comparative Medicine and Surgery, Philadelphia: Vol. VIII, No. 1.

Museum of Comparative Zoology, Cambridge: Bulletin, Vol. XIII, No. 3.

Royal Society, London: Proceedings, Nos. 252--3.

Naturwissenschaftlichen Gesellschaft, Isis, Dresden: Sitzungsberichte und Abhandlungen, 1886, Juli--Dec.

British Association for the Advancement of Science: Address of Sir J. Wm. Dawson, President.

The Earth, (Magazine,) Feb'y 12, 1887.

Société Linnéenne du Nord de la France, Amiens: Bulletin Mensuel, Jan., 1885--Dec., 1886.

State Society of the Cincinnati of South Carolina: Names of the Officers who served in South Carolina Regiments on the Continental Establishment, by Gen. W. G. DeSaussure. (2 copies.)

Communications from Messrs. W. B. Guerard and J. I. Westervelt, concerning the Earthquake, were read.*

Member Elected.

Mr. J. K. BLACKMAN.

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* Referred to the Commission appointed Sept. 23d, 1886.

JUNE 23D, 1887.

The President in the Chair.

Book Received.

California Academy of Sciences: Bulletin, Vol. II, No. 6.

Dr. Manigault exhibited a specimen of the Seychelles Nut, *Lodoicea Seychellarum*, from the Indian Ocean.

The Chairman concluded the reading of his observations upon the Earthquake.*

JULY 28TH, 1887.

The President in the Chair.

Dr. MANIGAULT continued his verbal remarks on the effects upon buildings of the earthquake shock of August 31, 1886.

Having restated his belief that all the damage done by that shock was produced by wave movements, he said that it was important to explain that only those houses, both of brick and of wood, which had more height than either width or length, could rock in a decided manner while the earth waves were passing underneath.

Such a building as the Memminger School, which, in its central portion under the dome, has more height than length of base, is a good illustration of this statement. For, on a certain day early in November, 1886, between the hours of 12 noon, and 1 P. M., while he was standing on the highest floor, a wave movement commenced which lasted over 30 seconds. It was slight in degree, but the waves followed each other with extreme regularity, and the direction of their coming was without doubt from the West. After a few confused movements, during which the inert mass of masonry was being set in motion, the entire building swayed from West to East, probably not more than

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* Referred to the Commission appointed Sept 23d, 1886.

Published Sep., 1887.

¾ of an inch to an inch on that floor, with a regularity that was striking. While, on the other hand, such buildings as the three churches of St. Michael's, St. Philip's and the Scotch Presbyterian, all three of which have more length than height, and the said length being in a direction East and West, could not under the circumstances sway back and forth from the nature of their proportions.

Their steeples or towers could rock, as they unquestionably must have done, but the effect of the waves· upon the buildings themselves, which has been so difficult to explain, can probably be accounted for by their having encountered, as they passed under the walls, an unyielding mass of heavy masonry, not susceptible of any oscillating movement, which was consequently rooted up by their irresistible progress, and made to crack in many directions, as also, in some instances, to lean from the perpendicular.

The leaning out of the four walls of the main central part of the Charleston College building was a marked feature of the damage done. The masonry there is of the most substantial kind, antedating the introduction of stone lime, and for the injury that was done to have occurred to such a perfect specimen of substantial brick work, proves how irresistible the waves were at that point. They were unable to detach the bricks from the mortar, as there was scarcely a crack to be seen afterwards, but they had the height and the violence necessary to make every outer wall lose its perpendicular position. There was nothing to indicate in the College building the direction from which the shocks came, and no clue as to direction could be obtained by the displacement of the horizontal cases on the floor of the Museum.

With regard to the oscillating or rocking movements, Dr. Manigault stated that he had tested the matter in company with an intelligent friend, and the conclusion seemed irresistible that, as the first wave reaches a building, it raises the end first reached, and causes the structure to tilt in the opposite direction. This can be illustrated by holding a volume upon a table, in the vertical position which it maintains on the shelves of a book-case, and slightly tilting it in one direction, as a round ruler, representing an earthwave, is inserted under the raised edge. As there is an appreciable distance between the crests of the waves, the structure has time to return to its normal position, and even somewhat beyond it, before the second wave strikes it, and thus the rocking motion is produced.

This seems simple enough and scarcely requiring explanation, but it is dwelt upon in consequence of the belief being very general that the effect of the first wave is to cause the structure to lean in the direction from which the wave has come, instead of the reverse, as has been explained. To produce a tilt in the direction from which the wave has come, it would be necessary for the entire base of a structure or column to be moved some distance in its bed. If this should occur the displacement of houses would be endless, and confusion would reign among neighboring proprietors, in consequence of changes in boundary lines ; whereas no such complications have been the result of the recent earthquake.

The Commission appointed to collect information concerning the Earthquake, made the following Report:

THE Commission of the Elliott Society which was requested to collect information with regard to the Charleston Earthquake of August 31st, 1886, Reports that it has received communications from four members of the Commission, and from five persons not members of the Society, whose names will appear attached to their communications. The Commission has endeavored to confine itself entirely to the facts which have been observed by those stating them, and these only will appear in the extracts given below.

Respectfully submitted,
L. R. GIBBES,
Chairman.

Hon. W. M. Thomas writes:

"I was recruiting my health at Summerville during the earthquake of the 31st Aug., and its preliminary shocks. On Friday the 26th I came to the city on the 9 A. M. train, and returned in the evening to Summerville. My daughter, Mrs. Easterby, informed me of the shock at 9.30 A. M. of that day — that it was severe and appeared to run from N.E. to S.W. or *vice versa.* Dr. Fludd, our attending physician, said it appeared to him to come from the S. W., and to be in the air, just about 20° above the horizon.

The next morning, about 5 A. M., while in bed I felt myself suddenly lifted, and as suddenly cast down, as if into my grave, by a shock which gave *no* premonition. It was very severe, but I was certain it was vertical, or nearly so — though it rolled off towards the S. W. apparently.

There were other shocks on Saturday and Sunday, apparently from N. E. to S. W. None that I can recall on Monday or Tuesday until 9.50 P. M.

I was then preparing to go to bed and had one stocking half off, while sitting in my chair. I was suddenly, without premonition, bounced up, and when I came down bounced up again. The lamp upon my marble top table went out, the water was thrown out of the pitcher, and the furniture moved in all directions, but most generally from S. to N.; the piano and bureau I noted particularly. The next morning I found the pillars of the house leaning from N. to S., with fissures in the ground, on the N. side of the pillars.

After the first shock that night there were repeated shocks, some say twenty and some forty in an hour. They were nearly incessant for the first hour. I was busy trying to get things out of the house, &c., and did not myself count them. No two could agree upon their direction, so, about 12 o'clock, I put up two pendulums, each about 5 feet long, hung from a long nail, with whitewashed fences at the back and lamps in front of them. What movements came after that were from directions between N. E. to N.

On Tuesday night I heard of the water springing up around us, but did not see it; but, being asked if there was danger from fire arising from openings in the earth, I answered 'no, I feared water,' and in order to test my theory tore the planking from the well-curb, and with a light examined the water. It had sunk. But in an hour after that, say 1.30 o'clock, it was up to the usual mark, and from that, it kept rising until, about 1 o'clock on Wednesday, it was up to the surface of the ground. At that time I left on the train to refugee in Columbia, above this alluvial region, and upon a granitic formation.

At Columbia I put up my pendulum against the wall of my room and found the shocks came in a direction from E. to N. E., and they were horizontal.

Before leaving Summerville, however, I had visited the *salses* (improperly called *geysers,*) and found at least one hundred in the space of an acre in front of Mr. Rugheimer's house. From salse to salse in some places were fissures — one over fifty yards long.

From my experience I was convinced that there was no volcanic action, but that the seismic force was local at first, vertical, not deep seated, in the limestone formation, (or limestone sea, as Humboldt calls it,) and that a large area of the coastal-plain would have to undergo the same movements in settling down, so that Summerville would be the last as well as the first place to feel their shocks, being the centre of the circle subject to disturbance.

That it was vertical, is proved by my own sensations; by the lamps going out as the air rushed down their chimnies when they were upheaved ; by the perpendicularity of the orifices of the salses, and the regular circularity of their mud emissions ; by the instantaneous coincidence of sound and force ; and by the want of uniformity of direction in the fall of furniture, &c. That it was not deep, is proved by the salses, (so Humboldt says, in Vol. I, p. 225, of his *Cosmos*). If it had been deep seated, the water would have come hot, and forced like a geyser out of a large orifice, instead of like out of a sieve, as it was."

Mr. Henry L. Barker of Oakley writes :

"On the night of August 31st, 1886, I had gone to Monck's Corner depot with a friend. When about two and one-half miles from that place we were startled by an appalling, unearthly roaring noise in the *South West*, being the direction from us of Summerville. The shocks of the previous Friday and Saturday flashed across my mind and I called out 'another earthquake.' We were in tolerably rapid motion at the time, and none of the party detected any thing like a jarring or upheaval of the earth, though my friend, Mr. S. P. Stoney, complained of nausea. A little distance on, we came to a house on the roadside, and found the occupants standing terror stricken in the road. Upon inquiry, to our surprise, they told us that they thought the house would have been shaken to pieces, so severe had been the shock. The first one took place at 9.55. While we were talking, the roaring again sounded in the S. W. and this time, not being in motion, we felt it very distinctly, as if some heavy weight had struck the buggy jarring it considerably. At the same time we could hear the windows of the house near which we were rattling and the timbers creaking and groaning. We then resumed our journey, and for the remainder of the drive, heard the roaring at irregular intervals coming apparently from the S. W., and varying at times to the W. N. W,, but not being conscious of any jarring or shaking. Upon our arrival in our summer village, 'The Barrows,' about 2½ miles from Oakley Depot, N. E. R. R., we were quite surprised to find that they had been terribly shaken up, plastering having been thrown down, chimney tops toppled over, and things thrown down from beaureaus, shelves, &c. Upon inquiry from parties who were in the village at the time, as to the direction from which the roaring noise had come, all agreed 'from Summerville,' or W. S. W. That both the noise and the wave came from that direction, seems to be borne out by the fact that the glasses, &c., which were thrown down, were all on the *West* side of the rooms and were thrown *towards the East.* Dr. Barker, who was in bed at the time, says that the studs of the chamber in which he was inclined towards the East, and a door between his room and one adjoining, which opened from *West* to *East*, was forced open, and striking against the basin stand caused the water to be thrown in the same direction. In other houses where things were overthrown, the direction was the same. During the night, and the following day, the shocks continued at varying intervals, and with varying degrees of intensity. At one moment it would be as though some heavy object had been hurled against the house, and the next time it would seem as though the house had been bodily lifted from its foundation and was rocking and tilting just as a boat on the water would do. From 9.55 on the night of August 31st, to 5.15 P. M. on September 1st, I had noted *twenty-four* shocks, plainly and distinctly felt. Others claimed to have felt many more than this, but I only noted those about which I was absolutely certain. The direction of all these shocks appeared to me to be the same, from S. W. to N. E., but there is a great diversity of opinion upon this point. My friend, Dr. Jos. P. Cain of Pinopolis, told me that at the time of the first and greatest shock, he and his wife were returning home after paying a visit, when he heard the awful roaring, 'which sounded as though some mighty propeller were grinding along with terrific force in a subterranean tunnel just under the road,' and added, 'I could almost swear that the sound came from *North* to *South*, but my wife is equally positive it was from *South* to *North*,' Thinking that the one shock was all they were to have, they continued on their way home, and Dr. Cain says that just as he was about to lift the latch of the gate which is on the *West* side of his lot, the earth again upheaved and 'the gate shook and rattled back and forth in his face, indicating that the shock had come either from West to East or *vice versa*,' he could not tell which. Others in that village (6 miles North of 'The Barrows' and 4 W. N. W. from Monck's Corner,) are equally positive that the movement was from N. W. to S. E. In connection with this I will mention that, in a store at Oakley Depot (frame building) goods were thrown from the West, South and North sides to a common centre. One curious feature of the disturbance is to be seen at 'Old Mulberry' plantation, (Mr. Milliken's). Commencing with the first house at the foot of the hill and going up towards the dwelling, the chimney of every *alternate* house is thrown off, and I noticed that alternation also at Mr. F. W. Heyward's Pimlico plantation, though not to so great an extent as at Mulberry.

The damage to dwellings on Cooper River, (Western branch,) has been slight where they were of wood. Brick buildings have in every instance suffered, some of them severely. Strawberry Church is also badly cracked. The cracks here, the worst of them that is, are at the four corners of the building and are open from *South* to *North*. One feature of the disturbance which has attracted wide-spread attention, is the innumerable mud spouts that occurred all through this, and the country below it. The pinelands are full of them, and they occurred also on the highlands on the riverside plantations, and in the rice-fields, both tide swamp and inland. Some are mere fissures in the earth, extending in various directions, others have the appearance of inverted cones. From all came a slippery, slimy, blue-grey mud, which seems to have been shot up in great volume, and with considerable force, judging from the extent of ground covered. On Dr. Barker's South Mulberry plantation, a low spot in the cornfield had been planted in rice. The extent of ground was, I suppose, an acre. The whole space had evidently been overflowed with the blue-grey stuff above mentioned, and the place was full of cracks and holes. From some of them in one part of the field the discharge was of the same slippery, slimy character, but the color was different, resembling the flesh of a pumpkin in appearance. The sand thrown from some of the 'cone holes' was filled with shining particles of some substance like mica, and had a more or less sulphurous smell. Another curious effect of the disturbance was observed a few miles below Oakley. On the Dean Hall plantation the wells overflowed, and all the sand at the bottom, old tin cans, and various things which had been thrown into them from time to time were ejected, and the wells thoroughly cleaned out. The same thing occurred at Dr. O. C. Rhame's 'Cote Bas' plantation, and on another place in the neighborhood of Strawberry Station."

Mr. Wm. B. Guerard states :

"On August 31st the thermometer indicated at 12 M., 86°, at 2 P. M., 88°, at 4 P. M., 84°, at 6 P. M., 84°, at 8 P. M., 82°, and at 10 P. M., 80°. The barometer at the U. S. Signal Office registered 29.799. There was no wind, a dead calm existed at 9.25 and 11.45 P. M., with clouds of a stratified-cumulus formation. . . .

Of the effects of this tremendous and unfamiliar force upon the various structures of the City and environs, the writer speaks with some confidence inasmuch as he was one of the Engineer Commission appointed to inspect buildings and in that capacity entered some 2300 edifices.

Charleston is situated upon a peninsular of land between the Ashley and Cooper Rivers, and its highest elevation is about 20 feet above mean low water. The immediate formation of the land is quaternary, and one finds the nearest rock below the City, as indicated by the boring of the Marion Square Artesian Well, to be an 11.5 feet stratum of limestone at a depth of 454 feet, and at the depth of 1230 feet, a stratum of sandstone 80 feet thick.

The nearest surface rock is the well defined line of granite some 110 miles to the Northwest of the City, which stretches across the State from Hamburg, through Columbia and Camden, to Cheraw on the Pee Dee Piver. . . .

The general direction of the wind is from the S., S. E. and S. W. One will find upon streets running N. and S. most of the buildings with their gables fronting the street, and upon the streets having an East and West direction, while the houses located upon the North side show their true front to the street, those on the South side will again push their gables to the street, here selecting the West as a favorite position for their fronts. . . . The majority of the dwellings are of frame, from two to three stories in height; the remainer are of brick. Not one-half dozen stone buildings can be recalled. The storehouses and places of business are built in the same manner as similar structures in all American cities and are often in continuous blocks.

It is of importance to state that the site of Charleston was originally cut up by creeks and marshes, and these have been filled up continuously as the value of lands increased, so that now it may be roughly estimated that one-sixth of its thirty-six hundred acres consists of what is termed 'made land.' In building upon the made land it is usual to pile the foundation more or less.

. . . It is a mistake to suppose that the framed dwellings upon made land escaped uninjured, the reverse is generally true, the under-pinning of their brick masonry was fractured repeatedly, the cisterns, also of brick masonry, were often crushed in, particularly in their arched tops, and oftener cracked through the key line. The frame houses were in some instances taken on the West end bodily seven inches to the South, and, in the same neighborhood, Council and Limehouse Streets, frames would be seen which had moved to the North three and one-half inches. It was observed also that the North and South horizontal swing would throw the building, chimnies included, so rapidly to the South that, apparently, the underpinning being more easily overturned upon its base than fractured, it would cant over with the superimposed building attached, but not, however, so far as to bring the structure to the earth. The flooring joists in these buildings frequently slid two or three inches horizontally from the sills, and the plastering of the gable walls and of all walls parallel with the gable were much fractured; it was observed also that the plastering of the walls gave away more readily than that of the ceiling. It was found in some instances that the foundations of the chimnies, say from 4 to 6 feet from the ground, were destroyed, and in the residence of one gentleman, it was found that neither of his chimnies had tops or foundations, the whole wrecked construction being held in position by the framing of the dwelling. Frame dwellings of good construction which were located upon the ordinary soil of the City suffered no apparent injury, except in the plastering and chimney caps.

The brick dwellings of the City should be divided into two classes, the one consisting of those well and thoroughly built, and the other of poor material and of unskillful workmanship. . . .

Poor brick houses upon made land were thoroughly shattered, well made buildings upon natural soil were usually cracked only in the gables.

Brick storehouses in blocks, or built with their flank walls touching those of their neighbors, were little hurt when located upon unmade land, with possibly an exception in the end buildings, but the same class of edifices upon made land were oftentimes fissured from coping to foundation; notably was this so in the section of the City between East Bay and the docks, and in Market Street from Meeting to East Bay, the former was originally a marsh, the latter a creek; the effect upon the porticos of the United States Custom House was doubtless due to the fact that this most solidly built national building was placed upon made land, thoroughly piled though the foundation was.

. . . An attempt was made to discover if there existed any continuous 'lines of least fracture' in the houses examined. But though the beginning of many of the efforts appeared promising, yet upon the whole so doubtful was the result that no statement could be made that they existed. Just here, however, it should be observed, that in that portion of the Charleston peninsular lying between Shepherd Street and the Rail Road Junction, some four and one-half miles North, the Rail Road tracks offered little or no signs of a great disturbance. After leaving the Junction, however, signs were plentiful, even North of Summerville.

It is to be remembered that the out-going Summerville train of that evening was ditched at the foot of the Ten Mile Hill on the South Carolina Rail Road, while the incoming passenger train on the North Eastern Rail Road, which was struck by the Earthquake between the Junction and Shepherd Street, was so slightly jarred that many passengers by it arrived two minutes later in the City with no knowledge of the disaster.

This portion of the peninsular is partly within the incorporated limits of Charleston but most of it is without; it is occupied by small frame buildings all upon unmade land, by highly cultivated farm plots, and by large Phosphate Mills, Oil Mills and other manufacturing establishments. No remarkable damage existed in that area, not even to the Rail Road tracks by which it is traversed. . . .

Certain it is that the country between the Junction and Summerville, and from the Ashley to the Cooper River, showed greater signs of vibratory blows than that portion between the Junction and Shepherd Street. The evidence of the effect is plainly exhibited upon the Rail Road tracks; the 60 ℔ steel rails were bent, not only in sharp and simple curves, but also into those of a reverse and compound nature; fish-bar bolt heads were cleanly cut off and portions of the track, ties included, were forced laterally hither and thither. Settlements in the track were frequent.

In the trestles, besides transverse displacements, the benches were often overturned. In the forests and fields earth fissures from three to six inches wide were constantly and commonly observed. These could easily be traced for hundreds of feet, and had ejected mud, sand and water.

Again, acres of land, in any one locality, would be dotted with sand craters, or holes, from two inches to three feet in diameter. These likewise exuded sands, mud and water, and in cases at the Ten Mile Hill, where measurements were taken, the sand thrown out was fifteen inches deep. It may be important to state that the general course of the fissures was N. E and S. W. Those observed in the neighborhood of Summerville had a direction North 65° East.

The Churches and Public Buildings suffered very severely, with few exceptions. They are situated upon good subsoil, the best in the City. Architecturally thay are not of a recent type; churches like St. Michael's and St. Philip's belong to the old English style of the seventeenth century. The First and Second Presbyterian, St. Paul's, St. Mary's, and others, of a modified Tuscan design; Westminster, Trinity, and Bethel, of the Greek temple character; Citadel Square, Grace, St. Luke's, and St. Matthew's, of the various Gothic orders.

Generally all of them are damaged, the difference being only of degree. . . . The Public Buildings were likewise well located as to natural foundation, the U. S. Custom House excepted, and, perhaps, the Post Office. They all exhibited fractures, the least hurt being the Fire Proof Building, but this structure is exceptionally massive; it is of stone and brick, and was specially designed as a place of safety for the public records of the County. Here only the porticos were somewhat displaced, but the ancient colonial edifice, built about A. D. 1768, as an Exchange and Custom House, and now occupied as the U. S. Post Office, lying about three hundred feet from the dock in the rear, suffered to such an extent as to require a complete system of shoreing to sustain the rent walls. . . .

In observing the position of articles of furniture and objects of art and elegance which were cast down by the vibration no new light was obtained, as to the principal direction of the earth wave, it was very common to see that the objects fell in the line of least resistance and the violent motion of the earth's crust was not only a horizontal and vertical one, but also a most decidedly compound movement.

The effect of this compound motion may be partially illustrated by the new position assumed by the collar-beam of the great bell of the Orphan House. This bell is of a large size and is suspended from a beam (the collar) properly bolted to a timber frame work in the belfry of the Orphan House tower. This bell does not oscillate upon an axis, but is struck by a hammer operated by electricity. The normal position of this collar beam is East and West, but after this shake it was found by measurement to have been shifted permanently out of place to the North, the East end of the beam moving Northwardly two and one-half inches, the West end one inch in the same direction; a rotary effect was also perceived, for the bell turned on its axis sixteen inches to the North and came back eight inches only. . . .

In some houses . . . framed pictures suspended by cords from the walls were made to revolve completely around, showing their backs where before their fronts were exposed. Those which showed this novel position were hung with the longest sides of the parallellogram in a vertical direction and their cords may be termed ornamentally lengthy. The swing of a door amply illustrates their movement.

Monumental shafts in the church yards also gave ample evidence of the complexity of this earth wave, they fell from their die blocks with an indifference to any one favorite or particular point of the compass, As all of the heaviest shocks occurred either at night or else at so early an hour in the morning that they found most people in bed, the visible effects at the moments when the walls were in the act of oscillation, were not perceived with any degree of certainty ; however, about 2.45 P. M. on Friday, 22d October, a gentleman, while conversing with two or three others in his office, had ample occular evidence of the movement of the walls of three three and a half story buildings situated in the office yard. It was a confusing and singular scene. His office, situated upon the second floor of a three and one-half story brick building, was surging to and fro, as were also the other walls in view, but the motions of the four did not unite with anything approaching a concurrent swing, the movement most apparent was from East to West and the reverse, and appeared to move, at the height of thirty feet, five or six inches out of their perpendicular. Though no walls in sight were precipitated to the yard, yet the crushed mortar of the masonry was violently thrust out horizontally, as each West wall would be thrown from its normal position to the West ; nothing of this kind was observed of the East walls.

This shock was supposed to last twenty seconds and in that space of time the yard was filled with a cloud of impalpable mortar dust. . . .

If it is supposed that the section of country which lies between Dorchester and Summerville, is above the seat of chief disturbance, then the shocks have left us no memorials that would establish the depth of the centre of impulse. The ejected sands, muds, clays and water are those which have always been found here near the surface. The clays seen in the sides of the uncurbed wells in Summerville are the same as those thrown up by a near by crater, and, though the water in many of these wells rose three to eight feet, yet the artesian wells in Charleston, 2,000 feet deep, were not affected. No evidence of a volcanic nature has come to the surface, not even was the exuded water warm in any established instance. Nor do we hear of the upheaval of any of the phosphate rock beds which are so frequent in this identical territory."

Mrs. Mary B. Reid sends this extract from her journal:

"FRIDAY, Aug. 27th, H's fever continues and his head seems troubled. About 8 A. M. he wanted to know what was going on down stairs — complained of noise when all was really quiet. Stranger still, he persisted that his cot had been heaved upward, then rocked 'just as if on a big wave in the surf, bearing me up bodily, then carrying me down again with a swing from East to West.' He refuses to believe it is the fever in his head.

Saturday, 28th, afternoon. Just now heard a dull, but heavy boom, thought it was thunder and ran out to look, but saw no sign of a storm. This is queer for it was perfectly distinct and about the same sound, now I think of it, as from the guns of the blockading fleet during the war. Perhaps it was the report of blasting at some of the works on the outskirts of town, like that which startled folks at the Custom House some time ago.

Sunday. The boys came in with a queer tale of earthquakes in Summerville. H. insists that was what he felt on Friday; 'It was not fever,' he says, 'else why should it have bothered me at that moment and neither before nor after?' I question the earthquake notion, else why did not I, just beside him, feel it also?

Wednesday noon, Sept,, 1st. . . . I had been down town . . . and was on my homeward way, in the middle of Meeting St. roadway, just by the Guard House, when I heard the coming roar. Suddenly remembering the shattered condition of St. Michael's, I looked up in dread at its steeple; it rocked, but did not fall."

Mr. J. Irving Westervelt, writing from Summerville, says:

"Not having seen any account of an upheaval of sea sand and small sea shells, I have pleasure in mentioning such deposit, to be found upon the surface, from a 'geyser' within three miles of this place, in the open pineland and between this and Ladson Station on the S. C. R. R. . . . So far as I have yet discovered, this is the only geyser where the orifice remains open [April 2d,] to the depth of ten or fifteen feet or more."

Dr. G. E. Manigault's notes are:

Having become somewhat familiar with earthquakes from experience with the few shocks felt in Charleston during the last forty years, and from encountering others in other countries, I immediately recognized the slight movement of Friday, 27th August, about 5 A. M., as produced by an earthwave. The disturbance was however so slight that the direction from which it came was not appreciable to me, nor would it have been, unless some delicate test had been prepared beforehand for indicating it.

The shock of Tuesday night, the 31st August, was felt at 10 minutes to 10. I was on the basement floor of my residence, about two feet above the surrounding soil, engaged in a game of chess, with my face to the West. A member of the household was seated at a Western window of the same room, about 20 feet from me. He heard the rumbling noise and felt the shock before I did, and immediately left the room, the two players being still seated as he passed us. The shock proving to be unexpectedly violent the other three persons in the room, including myself, hurried out to an adjacent garden walk, and, as I stood there, I felt distinctly a succession of waves passing under my feet, and moving in a direction a little N. of E. As it passed beyond me, I could hear from that direction the dull sound of crushed walls and falling chimnies with a few human cries.

The shock appeared to me to be a succession of waves following each other at tolerably regular intervals. As I stood up in the garden, when the movement was more than half over, there seemed to pass under my feet from three to four waves, about eight feet long and about six inches high. Upon examining the spot the next morning, there were two distinct fissures in the hard shell walk, about eighteen inches apart, quite straight and parallel, and with their directions about North and South, at right angles to the direction of the waves. Other fissures varying in width from a half inch to one inch were scattered through the garden beds, but none were as straight as the two above mentioned. I was unable to divide the whole disturbance into three successive shocks. The movement appeared to me to be continuous, with a gradual diminution in violence, the greatest intensity being during the first half.

My residence is in Gibbes St., in the Southwestern part of the City, immediately upon the waters of Ashley River. The tide was almost at its height, and there was a complete calm which had prevailed during the afternoon, and which I had particularly noticed, as the rising tide is generally accompanied by more or less breeze from the ocean. The sky was without a cloud and the stars were shining brightly. My impression of the direction from which the wave came is that it reached me from a little South of West, and travelled towards a little North of East. It came suddenly and was preceeded by a rumbling sound resembling a train of cars at a distance. During its continuance I was not conscious of any noise in the earth under my feet.

There was only one mud spout worth mentioning, in the yard of a residence opposite to my own, which I examined the next morning. The material thrown up was sand that had been slightly discolored by mud having been mixed with it. The diameter of the mass that had overflowed was three feet, with the top of the crater about five inches high, The crater was three inches in diameter, and its edges were so clearly defined as to lead to the impression that after the sand had oozed out, there was a quantity of confined gas that had escaped, and had continued to do so until the edges had dried and hardened. There was no indication of water having escaped from this mud spout, and, although it did escape in many places, I have heard no reliable opinion as to its having been heated.

It may be proper to add that the above recorded observations were made with much composure of mind. I had, at the suggestion of Prof. L. R. Gibbes, determined to note the direction from which came the wave of the next earthquake that I should experience, and being under no apprehensions for the safety of those under my care, I was able without difficulty to trust to my senses in observing what was transpiring."

Mr. W. G. Mazÿck notes his observations:

On the evening of August 31st, 1886, I was writing at a large dining table on the first floor of a frame building in Montague St., near Lynch. The evening was unusually sultry and unnaturally quiet. I was startled by a sudden and very forcible vertical motion, 'up and down,' of the house, which motion changed with inconceivable rapidity into a combined vibratory and undulatory movement accompanying a loud roaring and rumbling subterranean noise, and a singular whizzing sound in the air, apparently on a level with the tree tops, and somewhat resembling the hurtling sound made by a fuse shell. This undulatory movement disarranged the furniture of the room and overturned the lamp which was upon the table. I realized the truth instantly and started to run to the second floor to arouse my sleeping family, but upon reaching the door and seeing the imminent danger of fire, occasioned by the fall of the lamp among the papers and books with which the table was strewn, returned, extinguished the light, and ran as rapidly as possible up stairs, across the hall, through my wife's chamber, awakening her, and then into the chamber occupied by my daughters, awaked and hurried them into the street, traversing in all a distance of 185 feet, ascending a stairway of 17 steps and decending another of 19 steps, passing through the garden and reaching the roadway before the cessation of the tremor. From this fact I infer that this first shock lasted not less than 60, and probably as long as 75 seconds. I had no watch and therefore can make no definite assertion as to the length of its duration, but actual trial has proven that the distance traversed cannot be made in less time, with the delays incident upon my return to the room in which I had been writing, the extinguishing of the blazing lamp, and the awakening of the five members of my family in the rooms above. The evening, as I have said, was unnaturally still, the streets in the neighborhood are unpaved, indeed the quiet was almost perfect, and I am absolutely positive that there was no premonitory rumbling or other noise whatever before the first motion, which was distinctly vertical, an upward and downward pounding movement, changing, as mentioned, to the combined undulatory and vibratory motion which was accompanied by the noises described and which continued until after I had reached the street.

We were soon joined by our neighbors and the remainder of the horrible night was passed by all of us in the street, our party numbering about 25. In an effort to relieve the mental strain, especially of the ladies present, I suggesed that we should endeavor to determine the direction followed by the waves of the various shocks after the second, and also to estimate their duration, and the unanimous decision of the adults was that they all came from the Northwest, except the fifth which followed a line apparently at right angles to the others, this change of direction being noticed by even the children of our group, and being substantiated by the cries of the negroes, encamped several blocks East of our position, reaching us before the shock was felt, and also by the motion of the various rocking chairs occupied by members of our little colony, those facing North or South remaining comparatively undisturbed, and those in the transverse direction rocking violently. We failed utterly to reach any conclusion as to either the duration of these minor shocks, or the length or height of the waves.

From my observation of the ruins of the City I find that the region of greatest disturbance — if I may so term it — is in a line nearly parallel with Broad Street and extending from Tradd Street, Northwardly about 700 yards, to Market and Beaufain Streets. In this district the destruction has been terrible, and, though there are comparatively isolated points, notably East Battery, the College of Charleston, and Grace Church, where great destruction has also been wrought, there is no other portion of the City of equal area which has suffered so heavily.

A careful survey has shown that of all the buildings with porches or porticos, those facing the North, as St. Mary's Church, Hasell St., the North porch of St. Philip's Church, Church St., the old High School building, Society St., the 'Fire Proof' Building, Chalmers St., and the Wentworth St. Lutheran Church, and those facing West, as St. John's Lutheran Church, Archdale St., the U. S. Custom House, South Carolina Society's Hall, Meeting St., Charleston Hotel, Synagogues, Hasell and St. Philip's Sts., St. Paul's Church, Coming St., St. Mark's Church, Thomas St. and St. John's Chapel, Hampstead, have either wholly escaped injury or been comparatively slightly damaged, the most notable exceptions being the Main Police Station, Broad St., facing North, and the West porch of St. Philip's Church, St. Michael's Church, and Market Hall, facing West.

Of those facing East, those of the Hibernian Hall, Meeting St., and Mr. William Ravenel's residence, on East Battery, have been entirely destroyed, and the First Baptist Church, Church St., First Presbyterian Church, Meeting St., and Bethel Church, Pitt St., have been very seriously hurt. The First National Bank, East Bay, and Westminster Church, Meeting St., being the only ones escaping.

Of those facing South, that of the Medical College, was totally destroyed, and the College of Charleston, St. Philip's Church South Porch, and the City (Roper) Hospital, very badly injured. Spring St. Methodist Church, Centenary Church, Wentworth St., and Gen. Seigling's residence, East Battery, alone escaping great damage.

Of the Towers and Spires of the City, the S. E. angle of the upper portion of the masonry of St. Philip's steeple was destroyed; the Tower of the County Jail was injured in the S. E. angle in the same manner, and the S. E. Tower of the Roper Hospital, the Tower of the Unitarian Church, and the statue of Charity surmounting the Dome of the Orphan's House, were thrown over in the same general Southeasterly direction; the remaining towers of the City were badly cracked and otherwise seriously injured but no portion of any of them was thrown down.

Of 130 frame dwellings on brick foundations of varying heights, examined by me, 97 per cent have the foundations fractured on the South side and S. E. angle, the foundations being, in many instances, otherwise but little disturbed. One of these houses was thrown off of its foundation towards the South.

No record was kept of the direction in which chimnies fell, as I did not think that any reliable data could be so obtained, it being impossible to visit private enclosures, and the facts could not be ascertained from the streets, and besides this, large numbers of them, which were broken off but did not fall, were speedily thrown down by the owners or occupants of the buildings, to avert danger or additional disaster.

The only evidence of the height of the waves which I have noted was shown by the condition of the large warehouse of the New York and Charleston Warehouse and Navigation Co., at their wharf on Cooper River, which is built upon piles 60 feet long which are cut off level and capped with heavy timber. Into these caps heavy cypress supports are mortised, the tenons being 6 inches long, and upon these supports the building rests. At the time of the earthquake it contained about 45,000 tons of Fertilizers, &c. The shock raised this enormous bulk sufficiently to throw a very large number of the tenons clear of the mortises, and the building being moved slightly outwards, the tenons, failing to re-enter the mortises, rested on the caps.

From the facts above mentioned I am led to the opinion: that the duration of the great shock was more than 60 seconds ; that the earthwave moved from N. W. to S. E. ; and that its height was about six inches. In reaching this conclusion regarding the direction of the wave, I am influenced by the evident fact that the wave lifted that portion of a building with which it first came into contact — according to my observation of the buildings mentioned above, the N. W. angle — and throwing it forward as it passed beneath it, thus damaging its foundation, as stated, on the quarter opposite to that from which the force was first applied.

An extraordinary circumstance, possibly worthy of mention, as apparently indicating some peculiar atmospheric condition hitherto unobserved, was noticed by several pressmen employed in the various printing offices in the City, Their press rollers — made of a composition consisting mainly of glue and molasses — were found on the next morning to be covered with a peculiar slimy substance, and, to use the expressive language of the foreman of one of our largest establishments, 'appeared to have rotted,' going to pieces upon any attempt to use them.

One of the lamps at my residence had the wick 'jolted' into its interior, and those which were overturned fell towards the South. Of the doors opening East or West, those hinged to North posts were closed ; those hinged to South posts and opening West were also closed, while those opening East were thrown open. Those opening North or South happened, with one exception, to have been closed before the shock, and the one excepted was held open by being propped in that position with a heavy chair."

Mr. F. W. Schlepegrell says:

"Desirous of ascertaining what electrical disturbances had been observed in connection with the recent Earthquake, I called upon Mr. O'Driscoll, Superintendent of the Western Union Telegraph Co., who has been in its employ for over 20 years. He spoke freely on the subject and stated, in substance, as follows:

That the telegraph wires had been for a period of 4 months previous to the Earthquake, less disturbed by atmospheric electricity than at any other period during his connection with the Company. It has happened frequently before this period, and since, that the air has been so charged with electricity that the wires could be worked without a battery. He had made inquiries of the men who operated the telegraph instruments if they had observed any disturbances previous to the Earthquake, and all agreed in their statements that none were noticed, even by those who were working the instruments at the time when the first shock occurred, and who, in their alarm, rushed out of the building. Mr. O'Driscoll, who was sitting at his desk at the time, made his way to the safe, in order to close it, and returning, while feeling his way out of the building, as the lights had all gone out, was struck in the face by a number of the wires which pass across the room and which had been broken by the first shock, but felt no more effect from the contact with the wires than might have been experienced on being struck by them in their usual state. This happened while the earthquake was still in progress. As a result of these observations, Mr. O'Driscoll is very strong in his opinion that electricity had no connection with the earthquake, either as a cause or result.

About two months after the first shock, and during the time when the minor shocks were still felt, this City was visited by a thunder storm which was the first in a period of six months, and which was peculiar inasmuch as there was only one clap of thunder which was sufficiently loud to be distinctly heard, and this was so loud that it caused considerable alarm among the people as the rumbling which it caused was somewhat similiar to that experienced during an earthquake shock. The lightning which preceeded this clap of thunder struck one of the wires which enter the Western Union Telegraph building, and melting the wire in its passage across the room, caused a loud explosion with a brilliant flash. No injury was done except to the wire which acted as a ground conductor to the electricity. Mr. O'Driscoll's observations as to the absence of any disturbances on the telegraph wires for a considerable time previous to the earthquake, agrees with the absence of thunder storms during this period, which has been so much commented upon. . . . .

Mr. W. A. Schmidt, Superintendent of the local Telephone exchange, stated that no unusual disturbances had been observed on the telephone wires before the Earthquake. The night operator had the telephone at his ear during the first part of the first shock, before he realized his danger, but observed no unusual disturbances. The telephone is one of the most sensitive instruments for detecting the presence of electricity. On a hot, close evening, it gives off a crackling, frying sound, showing the presence of an unusual amount of atmospheric electricity. If the telephone wire passes parallel with and near to a used telegraph wire, the current induced by the latter causes a sound which can be distinctly heard. The current of an electric light wire passing near a telephone wire causes such a disturbance as to make it difficult to use the telephone.

There has been much discussion as to the velocity of the earthquake wave. There can be but little doubt, however, that it resembles more the velocity of sound than it does that of light or electricity. This being the case, it is clear that the telephone wires, some of which are 17 miles in length, would have given evidence of the disturbance before the shock arrived, had there been any evolution of free electricity.

In viewing these statements, given by persons who had special facilities for detecting electrical disturbances, we are struck by their unanimity in maintaining that no unusual electrical disturbance took place."

Prof. L. R. Gibbes reports his observations as follows:*

I. Before proceeding to the consideration of these observations let us recall, as far as possible, the earthquake-shocks which have occurred in our State in the preceding 75 years:

1. The great earthquake of the winter of 1811-12, which produced such remarkable effects in the region West of the Mississippi River, was distinctly felt in this State, both in Charleston and Columbia; the shocks being sufficiently strong to crack brick buildings, and to throw off chimney tops. There are doubtless a few persons still living who can remember these effects and give some account of them.

2. In one of the years 1832-35, a sharp shock occurred in Columbia, which I distinctly felt. I cannot now determine the precise year, nor the month and day, but think that it was in early Spring or near the end of Winter. I was then Tutor in Mathematics in the So. Ca. College, and at the same time studying Medicine with Dr. Thomas Wells of that City. I was standing in his office (a small brick building of two stories,) about 1 P. M., in front of the shelves containing a number of bottles of the drugs required in his daily practice, two other students being also present. Without warning that we could perceive, the building received a blow, apparently nearly vertically upwards, which made every bottle rise a few tenths of an inch from its shelf and fall again. No injury was done, but the startling crash was immediately attributed by some one of us to the fall of a heavy log put by Dr. W. on the fire in his room just above, when his door was quickly opened and he called out "what are you doing down there?" We returned his question, and gave our supposition, and his reply immediately came, "it is an earthquake shock," and such we were entirely satisfied it was. I do not think the occurrence attracted much attention in Columbia, as the duration was barely a second, but on returning to the College, our Librarian, Mr. Edward W. Johnston, (a relative of Gen. A. S. Johnston,) informed me that he was alone in the Library, and not only felt the shock distinctly but heard a low rumbling sound precede and follow it, coming apparently from the West, and passing off in the East.

3. On Saturday, the 19th December, 1857, an earthquake agitation was distinctly perceived in this City, some account of which I published in the *Courier* of Monday the 21st, and also a somewhat more extended account in the *Proceedings of the Elliott Society, Vol.* 1, p. 288,† This disturbance was felt in Georgetown, S. C. and in Savannah, but apparently not in Columbia nor in Augusta. On the 17th, two days before, occurred the earthquake which proved so destructive in Naples, and of which Mallet has given so excellent an account. I

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* It is proper to state that the following Report was written in detached portions, as the observations were made, and read at successive meetings of the Society, as indicated in its "Proceedings".

† Of this earthquake, Prof. McCrady also gave an account in the Proceedings of the Elliott Society, Vol. II, p. 1.

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have not seen his work and do not know whether it can be found in any library in this City.

4. In October, 1860, I think, the precise date I cannot now give, there happened another shock, which was not perceived by me, as I was paying a visit at the Charleston Hotel to friends recently arrived in the City, and amid the conversation of several parties in the room, and the noises in the adjacent street, I did not distinguish the sound, but on returning home found that it had been perceived there by several members of my family. I think that it was also mentioned by the papers of that date.

5. At some time in the Spring of the present year, 1886, I went, on a Monday morning, into the gallery of the Library of the College, and to my great surprise, found that a number of volumes piled on the floor of the gallery, against the Eastern wall, were now lying in a sloping pile on the floor, spread out over nearly the whole breadth of the gallery, and with other books on the floor on the other side, completely barricading the passage through the gallery. I had visited the gallery on Friday, and had left the books in order. The key of the Library was kept in President Shepherd's room in the College, and excepting the Janitor, no other person, as far as we know, had access to it, but myself. I immediately made inquiry, and learned that neither of the two had been in the Library since I left on Friday, nor had any visitor asked for the key to enter on the intervening Saturday and Sunday. President Shepherd asked me what could have caused the fall, I replied, there could be but one cause, *an earthquake shock.* This event had nearly passed from my recollection when President Shepherd reminded me of it on his return to this City at the beginning of October, 1886, and told me he thought it had occurred about April, perhaps somewhat earlier.

6. About the same time, but I cannot recollect whether before or after, a member of my family told me one morning that she had felt a decided earthquake shock during the quiet hours of the preceding night, and had also heard the accompanying rumbling sound. As no such occurrence was afterwards mentioned either publicly or privately, we considered it doubtful, although she still retained her conviction of its certainty. Now, I feel sure that she was right. I have been told that several other persons at different times had similar experiences, but I cannot quote them as they were not communicated to me in writing.

7. Near the end of June, 1886, during the sitting of one of the courts in this City, the assembly was startled by a loud noise and a violent shock, sufficient, if I remember rightly, to shake the building. A few days after the newspapers attributed it to the explosion of a boiler somewhere in the City, but I cannot recollect that this was ever proved. I have had search made in the papers issued about that date to find the paragraphs relating to those events, but without success ; nor have I been able to obtain the date from persons present. My chief reason for hesitating to say that it was a real shock is that I do not recollect hearing that it was perceived in Summerville.

8. On Friday, August 27th, 1886, at 9.30 A. M., a decided shock was felt at

Summerville, 23 miles from this City, and another on Saturday, the 28th. These were also distinctly perceived by a few persons in this City, but did not attract general attention here.

It would thus appear that the earliest of the shocks that preceded the great one occurred at least four months previously.

II. I reside at No. 38, East side of Coming Street, 80 yards North of Wentworth. The house is a wooden one, on a basement of brick, and at the time of the great shock on the 31st August, I was seated at a table writing, in my chamber in the third story, counting the basement as the first. I heard nothing of the booming or rattling noises which precede a shock, or if I did, intent upon my work, I did not distinguish them from the rumbling of the street cars on Wentworth St., or from the rattling of the coaches and drays that pass the corner of Montague St., opposite my house. The first intimation I had of the shock was from the horizontal agitation of my table, as if some one was rapidly walking or running from one room to another. I immediately recognized the character of the disturbance, and the rapid increase in the extent and violence of the agitation of the floor put the matter past doubt. I at once rose from my chair, put the lamp on the floor, and endeavored to make my way to my chamber door in order to reach the door of the opposite chamber where two of my daughters slept, the others being in the country. Staggering across the violently agitated floor, I succeeded in reaching without falling the door-post, at the same time calling to my daughters to come to me, if possible, for I could go no farther without falling. There, supporting them with my left arm, and still clinging to the post with my right hand, we passed the memorable 15 seconds, in which was effected that terrible injury to our City. When the violence and extent of the agitations had sufficiently subsided, we left our post, put out the flames from two lamps that had been ignited by falling, gathered up some clothing for those who had been roused from sleep, or else prepared for rest, and descended the stairs to the story below, then through the piazza and down the steps to the open space afforded by a large yard, the whole building still distinctly swaying to and fro during our descent. I have estimated at 15 seconds the interval during which the commotion was at its height, I cannot extend it to more than 20 seconds, and during this interval, the din was so great from the creaking of timbers, clattering of window sashes, &c., that although we saw the chimney-tops fall from the house next South of us, I do not think that any of us perceived the noise attending their fall, nor felt the concussion which must have been produced by their striking the ground 45 feet below. The vibrations of the post grasped by my right hand, were of course abundantly visible during those 15 seconds, and I estimated their extent as not less than one inch and not greater than an inch and a half, and their number at 6 to 8 per second, scarcely so many as 10 ; this of course means the vibration of the vertical timbers of the building, in the third story, about 20 feet from the ground ; it does not necessarily imply equal or corresponding motion of the ground on which the building stands. Of course several seconds preceded that interval of maximum agitation, and many more followed it during our descent to the yard, and while the building was yet swaying, so that the whole duration of the agitation, was certainly a minute or even more; whether the agitation of the ground lasted during that interval I cannot say.

After placing my family on benches and chairs in the open space in the yard, at a safe distance from surrounding buildings, I awaited with some anxiety the coming of the second shock, which I feared would be the culminating one in intensity. In 8 or 10 minutes (I have not the precise interval,) a rumbling roar was heard, as of a great chariot approaching over a stony road; what appeared to be the rattling of its wheels sounded nearer and nearer, and as it seemed to sweep by us, no agent indeed was seen, but we felt the solid earth beneath our feet, trembling, then surging, so that we swayed and staggered, and with difficulty kept one another from falling. The height of these surging earth-waves it is very difficult to estimate; I would put it at but a fraction of an inch, without venturing to specify that fraction; the horizontal motion was decidedly greater, perhaps one or two inches. I thought the second shock might be more severe than the first, and was quite prepared for greater damage to the buildings around us, although I did not impart my fear to those about me; but my relief was great when I found the second much less severe and prolonged than the first, and then expected the succeeding ones to diminish in violence. Such was the case in the three that followed before daylight. I reckoned five shocks in all that night, while others say there were seven, subdividing, I suppose, some of them into two.

Some time after midnight, some of my family, fatigued with watching, sought repose on a mattress laid on the ground in the yard protected by a coverlet and umbrellas. Others rested on chairs or benches in the yard, all at sufficient distance from the surrounding buildings; while I preferred a mattress laid in an unoccupied room in the kitchen (a wooden outbuilding). Towards daylight the coverlet became so thoroughly wet with dew, that I feared ill consequences, and persuaded those under its protection to take my mattress in the kitchen, and I retreated to another laid on the floor of the basement story of the dwelling house, and there enjoyed a few hours of repose, until awakened after sunrise by the entrance of my servants to prepare for breakfast. At no time during that night or any subsequent one did my daughters or myself sleep without the protection of a roof, but of course on the ground floor.

III. To observe and record the effects of the Earthquake require much journeying and patience, and more time than I can spare, and in many cases, the facts obtained do not furnish sufficient basis for consequent deductions. I have given but little attention to cracks, rents, and other injuries in buildings, as I would desire to see them on every side. and that cannot be done from the street. I have therefore given my attention to the *rotation* of pillars, columns and obelisks, on the surfaces sustaining their bases, and to the *projection* of urns, crowns, &c., from the tops of columns and obelisks. My examinations have been made in the following Cemeteries: 1. First Presbyterian Church, corner of Tradd and Meeting Streets. 2. St. Michael's, cor. Broad and Meeting. 3. St. Philip's, Church St., North of Queen. 4. Old Circular Church, Meeting St., above Queen, and adjoining the last. 5. Unitarian Church, Archdale St., North of Queen. 6. Lutheran Church, cor. Archdale and Clifford, and adjacent to and North of the last. 7. Bethel Church, cor. Calhoun and Pitt Sts. 8. Magnolia Cemetery.

I have enumerated these in the order of their distance from the Southern point of the strip of land between the Ashley and Cooper Rivers, on which the City of Charleston lies. With regard to the 3d, 4th, 5th, and 6th, which lie nearly in an E. and W. line, I have enumerated them in order of distance from the E. side of the City.

I have not examined the cemetery of St. Paul's, nor that of the Second Presbyterian Church, nor the cemeteries adjacent to Magnolia Cemetery. Additional information might have been obtained, if some one could have aided me by examining those cemeteries which I was unable to visit.

IV. For the sake of easy reference, I shall number continuously, the cases observed, now to be recorded, beginning with those in the cemetery of

The First Presbyterian Church.

1. Monument to Charles Macbeth.

An obelisk, height, from ground to summit, estimated at 15 ft., side of base, about 12 inches, was found *rotated* on its pedestal, against the sun, through 15°, and the centre of its base was found lying South of its original position at a distance estimated as ¾ of an inch.

2. Monument to Dr. T. Y. Simons.

An obelisk, height ft., side of its basal surface inches, rotated against the sun about 5°.

3. Monument to John White.

An obelisk, top about 8 ft. from ground, on pedestal about 2 ft. cube ; both the obelisk and the die of the pedestal were rotated with the sun, the die about 25° on the base, and the obelisk about the same amount on the surbase. Disturbance of centres was not obvious.

4. Monument to Gozen McLean.

An obelisk, rotated with the sun, about 22° ; centre of lower surface of obelisk was found 3 inches to the E. and 1 inch to the S. of its original position.

St. Michael's.

5. Monument to Col. Thomas Wagner.

A fluted column, 5 or 6 ft. high, on a pedestal 12 or 15 inches cube, a wreath (of stone) at top, with its plane nearly vertical, facing E. The column was found lying on E. side of pedestal in a N. and S. direction, base to the N. but a little S. of its former position on the pedestal, the top to the S., with the wreath now looking towards the West.

6. Monument to Creighton.

An obelisk, 12 inches base, twisted on its pedestal, against the sun, through 10° ; centre of its base lying S. (about 1 inch) and but little to the E. of its original position.

7. Monument to Charles H. Axson.

A column, about 6 ft. high on pedestal about 2 ft. cube, with wreath at top of column, facing W. Column was lying on E. side of pedestal, direction about N. 10° W., the direction of E. face of pedestal being N. 3° W. The top of column with wreath uppermost, lay near the pedestal, almost directly E. of its centre, while the base lay farther to the S.

8. Monument to Columbia T. Axson.

Next to, and only a few feet South of the last. A pedestal, about 20 inches cube, supporting an obelisk of 17½ inches base, surmounted by a cross, whose top was 8 ft. 2 in. from the ground. On this cross there had been a crown 8 inches high, which was now found imbedded in the earth, resting on what had been its upper surface, in a direction N. 8° E. from its former position, and 8 ft. 3 in. from the centre of the base of the pedestal, which had supported it, and therefore a few feet N.N.E. of the centre of the base of the last mentioned monument. The obelisk also was rotated against the sun, through about 14°.

St. Philip's.

9. Monument to Anna Serena Lucas.

A small urn, found lying 3 ft. 9 in. E. of seat at top of monument 6 ft. high.

10. Monument to Charles Pritchard.

An obelisk, 5 ft. 1 in. high, was found lying on S. side of its pedestal, 4½ ft. high.

11. Monument to Thomas Malone.

An obelisk 5 ft. high, lying on S. side of its seat, 2 ft. 10 in. high.

12, Monument to Mrs. Frost.

A column lying on S. side of its seat, 4½ ft. high.

13. Monument to William Aiken.

An urn, found lying N. 25° W. 4 ft. 6 in. from seat 7 ft. high.

14. Monument to Robert T. Turnbull.

A large urn, lying E. 5° S. 8 ft. 6 in. from seat about 20 ft. high.

15. Monument to K. Box.

A column whose shaft was lying on E. side of pedestal 1 ft. high.

Circular Church.

16. Monument to Mary H. Greenfield.

An octagonal pyramid or obelisk, rotated against the sun through 10°, centre of its base lies 1 inch N.E. of original position.

17. Monument to Susan Carrere.

A fluted column with a piece, 3 in. long and ¾ in. thick, broken out on W. S.W. arc of base of column; centre of base 2½ in. E.N.E. of original position.

18. Monument to Archibald Whitney.

An obelisk, slightly rotated against the sun ; centre of base slightly N. of original position. S.W. corner of plinth of obelisk is slightly chipped.

19. Monument to Mrs. R. Dewar Simons.

A large urn, found 2 ft. 6 in. S. 20° W. from seat 7 ft. high.

20. Monument to David Ramsay.

A fluted column, lying S. of its pedestal, direction of shaft nearly E. and W., its middle point S. 30° E. from centre of pedestal.

21. Monument to Richard Yeadon.

An obelisk, rotated with the sun through 6 or 7° ; centre of base lies one and one-half inch South of original position.

The urn was found S.W. of obelisk, 1 ft. 9 in. from centre.

22. Monument to William Lloyd.

A square, short pillar, rotated with the sun, 6 or 7°, centre of base is N. of original position.

In this cemetery there issued from under the N. side of a slab on the ground, covering the grave of Joseph T. Wells, a stream of water and sand, rising over the brick enclosure 2 inches high, and leaving sand at a distance of a foot or more from the aperture.*

Unitarian Church.

23. Monument to Taggart.

Obelisk, rotated against the sun, through 20°, with centre of its basal surface lying to the E. of its original position on surface of pedestal.

24. Monument to Mrs. Sylvia Hathaway.

On a rectangular base ; was found lying N. of its base, having fallen, apparently by turning on N. edge of its base, or possibly on one of the N. corners.

Lutheran Church.

25. Monument to Mrs. Lucretia Mouzon.

Base of obelisk rotated against the sun 3°, its N.E. angle was found S. 52° W. about one and one-half inch from original position.

26. Monument to Henry Cohrs.

Base of obelisk rotated against the sun 6°, apparently about the N.W. angle as centre of motion ; this angle being the least moved from its original position.

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* This cemetery lies West of that of St. Philip, and is only separated from it by a wooden fence.

27. Monument to Schroder.

Obelisk has fallen nearly S., tilted apparently over the Southern edge of its basal surface.*

Bethel Church.

28. Monument to Charles Smith.

Direction of Eastern and Western faces of pedestal, is N, 22° W.; the obelisk is rotated with the sun 7°, and its centre lies a little N. of its original position.

29. Monument to Matthew William Cross.

A marble slab, 6 feet by 3, on six pillars about 2½ feet high; direction of its narrowest sides, the Eastern and Western ones, was originally N. 30° W., they now lie N. 5° W., being rotated with the sun about 25°. The slab has rotated about its NE. angle, which still rests on its own pillar, but little disturbed from its original position except by the rotation. In its rotation the slab has carried the top of the Southeastern pillar inwards, and it now lies under the slab, nearly parallel to the present direction of the longer side; the N.W. pillar has fallen outward, broken in the fall but lying nearly in the present direction of the shorter side; the S.W. pillar lies in a Northeasterly and Southwesterly direction, nearly parallel to the corresponding diagonal of the present position of the slab. It lies entirely outside of the area formerly covered by the slab, but with its top now only a few inches from the former place of its foot, while the foot is the farthest away.

Magnolia Cemetery.

30. Monument to O. Guerard.

An obelisk, 16 ft. high surmounted by square vase or urn. The urn already replaced at time of my visit, had been found on the ground, in a perfectly upright position on its base, at a spot pointed out to me, 3 ft. 6 in. N. by E. from centre of obelisk. The obelisk had been rotated, in which direction my informant could not say, and I could not now determine, as it had been replaced.

31. Monument to H. Clark.

A fluted column, was found with centre of basal surface 1¼ inches from its original position towards the S.E., the circumference of that surface projecting 1 inch over the edge of the surbase of the pedestal. The wreath surmounting the column, which originally faced nearly N. now faces a few degrees W. of N.

32. Monument to the Charleston Light Dragoons.

An obelisk summit 31 ft. above the soil, and mounted on an elevated pedestal, whose N. side faces N. 5° E. Obelisk very slightly, if at all, rotated, but the W. edge of its base was found projecting 2 in. beyond the W. edge of the surbase of the pedestal, and the centre of its base was now about 3 inches W. and 1 in. N. of its original position. On the E. lower edge of the obelisk, was seen a large flake, not yet detached, but showing a cleft about a quarter of an inch wide at bottom, and running upward about 8 inches ; the thickness of flake at bottom being about 1 in. On a subsequent visit this supposed flake proved to be two fragments, one at N. E. and the other at S. E. corner of base of obelisk, both having now fallen.

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* This cemetery is North of the last, and only separated from it by a wooden paling fence. The sides of the pedestals in this, and each of the preceding cemeteries, face the cardinal points of the horizon approximately.

Where distance of fallen object from pedestal is not given, it lay at its foot, or quite near it.

33. Monument to Hugh S. Legare.

A fluted column, with Corinthian capital whose upper surface was 22 ft. from the ground supporting a globular urn about 18 inches in diameter, surmounted by a flame ; the height of this flame was about 24 feet from the ground. This flame was found detached, and lying on the ground N. 15° E. 18½ ft. from the centre of the monument. The globular urn was found lying on the ground in an inverted position, 9 ft. from centre of monument. The pedestal which faces N. 25° E. is reached by ascending several steps on each side ; the steps on the N. side were found battered at several points, portions of the sharp angles broken off, and on them lay fragments of the handles of the urn, and of the pall which had been represented as wound around the handles of the urn.

34. Monument to Mrs. J. L. Morgan.

An obelisk, originally facing N. 35° W., now N. 25° W., being rotated with the sun through 10°.

35. Monument to Langdon Cheves.

An obelisk, originally facing N. 9° W., now N. 3° E., being rotated with the sun through 12° ; the centre of its base seems to be somewhat S.E. of its original position but could not be certainly determined.

36. Monument to W. Taber.

An obelisk, originally facing N. 22° E., now N. 35° E., rotated with the sun through 13°. Centre of base seems to be in an Easterly direction from its original position.

37. Monument to Laura McDowell.

Originally faced N. 40° E., now N. 35° E. ; rotation against the sun 5° ; centre of base is 1 in. W. and ⅝ in. S. of original position.

38. An obelisk, without inscription, facing N. 9° W., centre of pedestal was found 2½ in. N. 41° E. from original position.

39. Monument to Alexander Mitchell.

Faces N. 3° E. ; centre of column was found W. 15° N., 1¾ in. from original position.

40. Monument to Phineas Pierce.

Rotated 3° or 4° against the sun ; centre of obelisk ⅝ in. N. E. of original position.

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V. To the foregoing I will add a few observations made on buildings in the City, continuing the succession of numbers.

41. The chimneys of the house No. 36 Coming St., E. side, next S. of my residence, fell within a few feet of the piazza of my house, the whole of the portion projecting above the roof being included in the falling mass, and as the northern surface of these projecting portions was continuous with the surface of the north wall of the building, they fell almost entirely clear of the building, a few bricks only breaking the eaves of the tiling, and injuring the gutters in some degree. The middle point of the projecting part of the western chimney, was about 45 ft. above the ground, and this mass fell in direction N. 35° W., and the central portion as it lay on the ground, was estimated to be about 18 ft. from the north wall of that building, some of the bricks rolling about 5 ft. further, blocking up my street door on the inside. The eastern chimney fell in like manner, but falling among shrubbery less attention was given to it. The arches over the flues of these chimneys were blown away in the cyclone of 25th Aug., 1885., but had been replaced soon after.

42. On the morning after the earthquake I observed, lying in the upper piazza of the house at S. W. corner of Bull and Coming Sts., a pile of bricks, which had evidently come from the eastern chimney of the house next south of it, both houses being on the west side of Coming St. By personal examination I found that the hand rail and balusters of the piazza were not broken, though they showed marks of the battery to which they had been exposed. The bricks in the piazza must therefore have passed above it, and I find by measurement that the hand rail is 13 ft. from the ground and about 13 ft. from the estimated centre of the chimney, which was enclosed within the wooden building to which it belonged. By measured lines, and angle with pocket sextant, the summit of the present chimney, (rebuilt) is 26 ft. from the ground; the former chimney was most probably a foot or two higher. The bearing from the chimney of the marks on the hand rail is N. 10° W. by compass.

43. In the S.E. room of the College Museum, in east wing (now taken down,) there was a case containing minerals or shells, about 3 ft. high, 3 ft. wide, and 12 ft. long, placed parallel to the front of the College, which faces about S. 30° E. In consequence of the bending downwards of the floor, from the weight resting on it, several of the legs of this case had been furnished with small pieces of wood placed under them, and tacked to the floor, to preserve the horizontality of the case. Several days after the shock. I obtained access to the Museum to see its condition, and found this case north of its former position, and nearly parallel to it, each leg about a foot distant from its former position, (as marked by those bits of wood,) in direction N. 10° W. by compass. In the S.W. room (now taken down) there was a similar case, similarly placed. This I found oblique to its former position, the eastern end north of its former position, the western one still farther south of its former position, so that the rotation was against the sun through some 25° or 30°; the centre of the case seemed a few inches S. of its former position, as well as I could judge, for the former places of the legs on the floor were not as distinctly marked as in the

other room. Some beams from the ceiling fell in this room and injured the cases below them, but I do not think that this case was struck by them.

44. The southern half of the roof of each of the wings of the College was most seriously injured, presenting the appearance of having been driven downwards by a tremendous blow from above, the broken joists of the ceiling of the upper room in the west wing projecting downwards into that room, nearly touching the cases beneath, as mentioned above. The northern slope of the roofs was much less injured, while portions of the north walls under the eaves leaned outwards, threatening to fall, and did afterwards fall during one of the subsequent minor shocks.

45. The Statue on the Cupola of the Orphan House was found leaning at an angle of about 50° or 60° with the horizon, and in direction S. 40° E., as well as could be determined by compass.

At another time, I propose to discuss the facts above given, and to present such conclusions as I may be able to draw from them. I have collected these facts unaided except by some members of my family, and in some cemeteries by the keeper of that cemetery. The aid of the keeper was important as it prevented me from mistaking some of the effects of the cyclone of 1885, for those of the earthquake of 1886.

The Chairman read the following

Remarks on his own observations given in the preceding Report.

BY PROF. LEWIS R. GIBBES.

It is evident from the preceding account of 45 cases, that the directions in which bodies fell during the commotion were very various, and great care will be required to deduce results of sufficient value. In some cases the data are insufficient, either being unattainable, or in a few cases overlooked at the time of examination.

We will begin with the most distinct cases, which are not many, in which a mass was found at some distance from the foot of the pillar on the top of which it originally stood, and these cases I regard as indicating the direction of the original impulse or shock; and the velocity of projection, supposed horizontal, can be computed by well known methods. Each of these bodies must have been attached with sufficient firmness to enable it to partake of the motion of the whole structure, for if not attached it would be left behind and simply fall off on that side whence the impulse came. Some of its energy of motion must then be expended in breaking this attachment, and the calculated velocity of projection must always be less than that due to the energy of the original impulse. Six cases, Nos. 33, 30, 8, 42, 13 and 41, indicate very distinctly these directions respectively, N. 15° E., N. 11° E., N. 8° E., N. 10° W., N. 23° W., N. 35° W. The velocity of projection varies from 3 feet per second in case 30, to 15 feet per second in case 42. If we omit case 41, in which the data are far less precise, the remaining five cases will give an average velocity of projection of 10 ft. per second, and an average direction very nearly *north.* These results imply impulses from points varying from S. 23° E. to S. 15° W., with an average direction from *south.* With these five cases may be associated No. 43, which indicates pretty clearly an impulse from a point S. 10° E. The six cases here mentioned range from St. Michael's Cemetery to Magnolia Cemetery and so far tend to give an average result for the portion examined (about 3 miles in length) of the strip of land between the two rivers.

Two cases, Nos. 9 and 14, both in St. Philip's Cemetery, give each a velocity of 6 ft. per second with directions, E. in first case, E. 5° S. in the second, showing an impulse from the *west.*

In one case, No. 19, the fallen mass was found S. 20° W. of its pillar, indicating an impulse from the opposite point of the horizon. But it lay so near its pedestal, that it may perhaps be equally probable that it was but weakly attached, was broken off by its own inertia, and so fell behind, under an impulse from S. 20° W., and so it might be associated with the first six.

If in the preceding cases, the direction of the impulse be supposed, not horizontal but obliquely upward, then the velocities of projection will respectively be greater than those given above; but we have found no means of determining the angle of this obliquity.

We may next examine the direction of falls of obelisks and columns from their pedestals and their motions on their pedestals, without falling, accompanied or not by rotation about a vertical line; but here our success will be small. The amount of adhesion or of friction between the lower surface of pillar, and upper surface of pedestal is unknown and also varies in different cases; in some cases, the two surfaces are comparatively smooth, in other cases, a bed of plaster of Paris, or a sheet of lead is interposed between two roughened surfaces. Opposite rotations may be observed in obelisks within a few yards of each other. The conclusions that may be drawn from the present class of facts agree, in the main, with that drawn from the former, namely that the impulses came from some southerly quarter; but there are clear indications that some impulses came from an easterly direction, some from a westerly, and some even from a northerly direction, of which last the Statue on the Orphan House may be taken as an example. Some of these cases may be referred to a vibratory motion, ending in the overthrow of the columns, some in one direction others in opposite directions; but this will require a particular relation between the periods of oscillation of the earth, and of the column, which cannot be shown, or may not exist. These varied directions of fall were exhibited by columns within a few hundreds or even dozens of yards of each other, in the Cemetery of St. Philip's, and the adjoining one of the Circular Church. Some portions of the strip of land between our two rivers, seem to have trembled as if each of such portions was a jelly-like mass, changing the direction of the motion of its parts, under the varying strains produced in its internal structure. In many cases of rotation the base of the obelisk, was not only rotated about one of its angles as Gray's mode of explanation requires, but this angle was also displaced from its seat on the pedestal. When this displacement was small we may suppose the rotation to have taken place about a point not far from that angle, but within the area of the base, at some region of greatest adhesion or friction, as Mallet supposes in his explanation. But frequently there has been motion of translation as well as of rotation, as though the obelisk had made a jump during the rotation or after it, or had slidden along the surface of the pedestal. In case No. 3, we have a remarkable example, where the pedestal has rotated through 25° on its plinth, and the obelisk through 25° more on the pedestal, the displacement of the three centres from their original positions being very small. In case No. 29, we have another remarkable example, a large slab rotated through 25°, around a point at one of its angles, resting on one of its six pillars, three of the others being thrown down during the motion.

If sufficient data were at hand, we would next endeavor to determine the region at the surface of the earth, immediately over the focus of disturbance below, and then the depth of that focus beneath the surface. The solution of these problems requires that we first determine the position of three points or regions of *greatest* disturbance on the surface of the earth. But sufficient data for these determinations are not furnished either by the facts collected by the members of the committee, or by the reports of the very few persons who have complied with our request to collect facts and send in to us their observations. These observations relate almost entirely to injuries sustained by structures in Charleston and Summerville, and in the absence of the requisite additional data, we can only make a first approximation, by taking a region about midway between these two places as that which is nearly vertically over the focus of disturbance beneath, and this region will lie not far from the railroad station known as 10 Mile Hill. The depth of the focus of disturbance, will then be about 11 miles, on one of the hypotheses usually made, or about 15 on the other ; depths much greater than those previously assigned to foci of earthquake disturbance.

In each of these two cases, the disturbance is supposed to proceed in every direction from a central region, or focus of disturbance, radiating along lines approximately straight, but diminishing in intensity, or amplitude of disturbance as it proceeds outwards from the centre, this diminution at each point of the line traversed depending, according to some law, on the distance of that point from the focus. At a point on the surface of the earth, vertically over the deeper seated focus of disturbance, the direction of the disturbance when it reaches it, will be, approximately, vertically upwards, and the effects produced will be almost entirely in that direction, with far less or but little horizontal disturbance. This point on the surface of the earth has been called the *epicentrum ;* but we may call it simply *the surface centre.* Proceeding outward every way from this surface centre, the lines radiating from the focus will meet the surface of the earth more and more obliquely, and effects will be produced both in the upward and horizontal directions, and if we regard at present this obliquity only, the intensity of the disturbance in the upward direction will continually decrease, and that in the horizontal direction will increase, each at a rate easily calculable. But, as we have said, the intensity of the disturbance, along the lines radiating from the focus, continually diminishes the farther we proceed from the focus, and therefore from this cause, each of the above effects, vertical and horizontal, supposed already calculated, must be diminished in a ratio also easily calculable. As the intensity in the upward direction is diminished by each of these causes, it will continually diminish as we go outward, until it becomes imperceptible. But the intensity in the horizontal direction is little or nothing at the surface-centre, and continually *increases* from one cause, the obliquity, as we proceed outwards from that centre, while it *diminishes* from the other cause, namely the decrease of the intensity of the original disturbance, as it proceeds to greater distances from the focus. But it may be shown that the increase and the diminution follow different laws, and the horizontal disturbance will, at a certain distance from the surface-centre, attain its greatest intensity and afterwards diminish continually. These points of maximum horizontal disturbance, will lie approximately in a circle around the surface-centre and the radius of this circle can be calculated when there is given, the rate of diminution of the intensity of the disturbance along the lines radiating from the focus.

In the first of the two cases mentioned above, the intensity of disturbance along the radiating lines, is supposed to vary inversely as the distance from the focus. In this case it can be shown that the radius of the circle of greatest horizontal disturbance is equal to the depth of the focus below the surface-centre ; so that if one of these quantities can be found, the other will become known. Supposing Charleston and Summerville to be at the two extremities of a diameter of that circle, then the surface-centre would be midway, say at about 11 miles from each ; and the focus would be about 11 miles below that centre.

In the second case, the intensity is supposed to vary inversely as the square of the distance from the focus, when it can be shown that the radius of circle of greatest horizontal disturbance is to the depth of focus as the side of a square is to its diagonal. This would put the depth of the focus at about 15 miles.

These two methods of investigating the position of the focus, were used, and their demonstrations, by means of the *calculus*, given by Mr. Robert Mallet nearly 30 years ago. He applied them, if I mistake not, to the discussion of the depth of the focus observed in the earthquake which so severely injured the City of Naples, on 17th Dec., 1857, two days before the shock felt in this City the same year, as already mentioned. In the appendix to the present paper, I have given a *geometrical* explication of the first method, which will be easily apprehended by those who understand the geometrical properties of the circle. The second method is one degree more complex, and the explanation is therefore less simple.

I have shown in my preceding paper that the average direction of the most powerful shocks in our earthquake, was towards a point about north, and this direction we now see, is *towards* the focus of disturbance and not *from* it. It would seem then that this disturbance is not of the nature of an explosion or release of an outward stress, in which the wave is one of compression, proceeding from the focus outwards, the motion of each successive particle being also in the same direction, outwards ; but rather of a release of an inward stress, in which a wave of expansion, corresponding to the rarefied portion of an aerial sound-wave, proceeds from the focus of disturbance outwards, while the motion of each successive particle is in the opposite direction, inwards.

There is no known volcanic agency at work within hundreds of miles of us, none nearer than Mexico or the West Indies, and if at work would, as is generally supposed, act outwardly or explosively; so that we may leave this agency out of consideration for the present. The depth of 11 or 12 miles, would be sufficiently great to give to pent up water and steam, a temperature of about 1200° F., but this powerful agency, if supposed to exist, would act outwardly, and so would not meet the circumstances of our case.

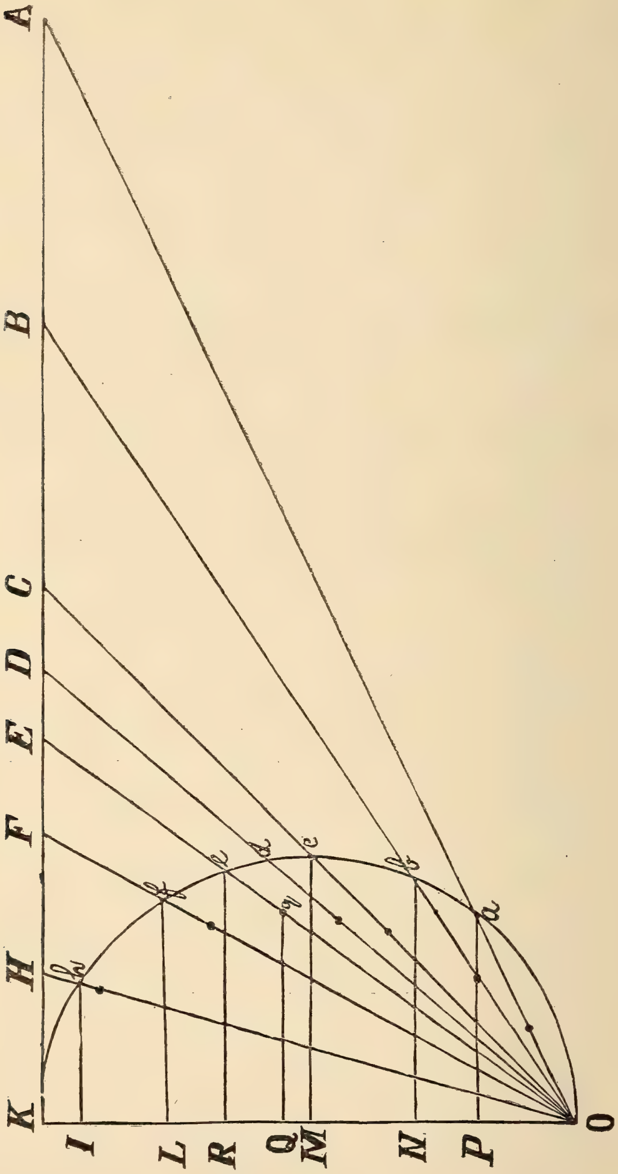
If we could suppose a cavity or cavities in the strata beneath us, compressed by the strata above them, the release of this strain by the crumbling in of their walls and the closing in of one or more cavities would produce a wave of the character expressed above, and so far meet the circumstances of the case. But the existence of such cavities at several places in the coast region of the middle and southern states, implies corresponding variations in the average density of the mass of strata beneath each corresponding station at the surface of the earth; which variations in density might be detected by observations along that region. That there are considerable variations of density, in the beds and strata along our Atlantic region appears to be certain, from the discrepancies between the astronomical and geodetic latitudes of certain places, as given by the Coast Survey, after all the corrections have been made for the dimensions of the spheroid on which the triangulation has been developed; and it is not impossible, that a part at least of the observed discrepancy between the two latitudes may arise from actual *deficiency* of matter, that is from an empty cavity, but this at present cannot be proved. No indications have yet been given where lie these regions of maximum and minimum density, nor is there anything to shew that one of the last underlies our City or its neighborhood. The southern stations whose latitudes have been compared and published by the Coast Survey lie along a line at some distance from the coast, and near the foot of the mountains, whose mass would tend to produce additional complication. A comparison of the astronomical and geodetic latitudes of stations along our *coast line* would be of interest in connection with our subject.

I am unable to present any corresponding facts observed at Summerville, or in the surrounding country. I have heard of no cases in which bodies have been distinctly projected towards the S. or S. E., that is, *towards the surface-centre*, such as I have observed in the cemeteries in this City. I can only await the coming in of more facts than I was able to collect.

APPENDIX TO ABOVE REMARKS.

Depth of Focus, and Circle of Maximum Surface Disturbance.

1. In figure, on page 168, let O be *Focus* or *Origin* of disturbance at distance KO below the surface of the earth KA. Suppose a wave of disturbance to be propagated with velocity nearly uniform, along lines OK, OH, &c., OA, it



will first be felt at K, in a vertical direction, and successively later at H, F, &c.,

to A, and in direction more and more nearly horizontal. The *intensity* of the disturbance at the surface in the direction of these lines OK, OH, &c., to OA, will be greatest at K, and diminish, and become successively less at H, F, &c., to A, according to some law depending on the distance of each of these points from O.

2. We may first suppose the law to be this: the intensity diminishes as the distance increases, so that, at double the distance, the intensity is reduced to one-half, at a triple distance to one-third its intensity at K; at half the distance it is twice as great, and so on. Expressed mathematically, the intensity is said to be *inversely* as the distance, or the distance multiplied by the intensity is a constant quantity.

3. If now we take OK to represent the intensity at K and on OK describe the semicircle O*a*, *b*, &c., K, it will cut off on the lines OA, OB, &c., OK, the lines O*a*, O*b*, &c., OK, which will represent respectively, the intensities at A, B, &c., K, on the same scale as that on which OK represents the intensity at K. For the triangles AKO, and K*a*O (the line K*a* is not drawn in the figure), have a common angle at O, and a right angle at K and *a*, respectively. They are therefore similar, and OA : OK :: KO : O*a*, or $\mathrm{O}a \times \mathrm{OA} = \mathrm{OK}^2$ = a constant quantity. So $\mathrm{O}b \times \mathrm{OB} = \mathrm{OK}^2$ and so on; which agrees with the law above supposed. It is also evident that O*a* : O*b* :: OB : OA, that is the lines O*a* and O*b* are inversely proportional to the corresponding distances OA and OB, which is the same law a little differently expressed.

4. But as already said these forces act at A, B, &c., along the lines OA, OB, &c., obliquely to the surface, and produce effects partly in a vertical direction and partly in a horizontal one. To find these effects at A we must resolve the force O*a* into the two OP and P*a*; the first OP shows the direction of the upward force at A, and its intensity (on same scale as before), the second P*a*, shows the direction and intensity of the horizontal disturbance at A. In like manner ON and N*b* show the direction and intensity of the upward and horizontal disturbances at B; OM and M*c* at C, and so on. By comparing the lines OP, ON, and OM, &c., it will be seen that the upward force increases steadily from A to K, where it is greatest, or has its *maximum*. In like manner comparing the lines P*a*, N*b*, M*c*, L*f*, I*h*, which represent the intensities of the horizontal disturbance at the points A, B, C, F, and H, it will be seen that the greatest of these is M*c*, and that the intensity of this force increases from A to C, that *there* it attains *its maximum* and decreases thence to F, H, and K, at which last point it disappears entirely, the whole disturbing force being here exerted entirely upward and vertically. By the properties of the circle the line M*c* is equal MO, and therefore KC is equal to KO, that is, *the distance of the point of maximum horizontal disturbance on the earth from the point* K *on the surface, vertically over the focus of disturbance, is equal to the depth of that focus of disturbance* O *beneath the point* K. This point K is the centre of the circle that passes through all the points of maximum horizontal intensity on the surface of the earth, and KC is radius of that circle and the centre K may be found geometrically if three or more such points be given on the surface.

This radius KC depends only upon the *depth* KO of the focus and not upon the *intensity* of disturbance at this focus O.

5. But we may also suppose that the intensity of the disturbance varies inversely as the *square* of the distance ; that is that the product of the intensity by the *square* of the distance is a constant quantity, and for the propagation of a disturbance in a homogeneous medium, mathematical and physical considerations indicate this as the law of the diminution of the intensity.

6. In the preceding case, it was shown that when OK was taken to represent the intensity at K, then at any other point on the surface as A, Oa will represent the intensity at that point A, and Oa was taken as much smaller than OK, as OK is smaller than OA. In the present case, where the intensity multiplied by the *square* of the distance is constant, we must on the line OA, *again* cut off a portion as much smaller than Oa, as OK is smaller than OA ; in the figure, this portion extends from O to the dot marked on the line Oa, which dot is not lettered in the figure, to avoid complexity. In like manner, the proper lengths reckoned from O, are marked off by dots on the lines radiating from O. If a curve (not drawn in the figure) be conceived to pass through all the dots thus placed, it will in this case take the place of the semi-circle in the preceding case.

7. Now, if from each dot in this curve, a line be drawn perpendicular to OK, these will show the direction and intensity of the horizontal disturbance at A, B, &c., to K, and from the form of the curve it will be evident, that one of these lines must be greater than any other. The position of this longest line can be found, by a process to be given presently, and the line has been drawn in its proper place in the figure, indicated by Qq. The radiating line from O through q, cuts the semi-circle in e, and the surface of the earth in E, which point is therefore the place of maximum horizontal disturbance at the surface, in the present case, and is nearer to K, than is C in the preceding case. The position of this point E is such that if on KE a square be described, KO will equal the diagonal of that square, and so if KE be known, then KO, the depth of the focus also becomes known. Now the side of a square is to its diagonal as 1 is to $\sqrt{2}$, or as 1 is to 1.414 ; hence if KE, the radius of circle of greatest horizontal disturbance, be estimated at 10 or 11 miles, as in the preceding discussion, then KO will be 14 or 15 miles as there stated. The angle of emergence of the wave of disturbance at C, in preceding case is 45° ; at E in present case it is 54° 14′.

8. The position of the line Qq was found thus. Draw the line eR parallel to AK, then it may be shown (by the calculus) that KR equals $\frac{1}{3}$ KO. Now reversing our steps, first take KR$=\frac{1}{3}$KO, draw Re parallel to KA, cutting the circle in e ; then draw OeE, cutting the surface KA in the required point E in the circle of greatest horizontal disturbance. The line OE, cuts the curve passing through the dots, as above mentioned at q, and the line Qq was drawn parallel to KA. Since KR is $\frac{1}{3}$ of KO, it follows that Ee is $\frac{1}{3}$ EO, then Oe is double Ee, and by a well known theorem in geometry, therefore the square

on KO is double the square on KE, and hence KO is equal to the diagonal of the square on KE, as stated in the preceding section.

9. The calculus gives these results more readily though less easily accessible to most students. Supposing the intensity of disturbance to vary inversely as the n^{th} power of the distance from O, it will vary directly as the n^{th} power of the sine of angle of emergence at the surface, which angle call A. Then the intensity of the horizontal disturbance will vary directly as $\cos A \sin^n A$. Differentiating this expression and treating for a maximum, we shall find $\cos^2 A = \frac{1}{n+1}$ when horizontal disturbance is a maximum.

When $n=1$, then $\cos^2 A=\frac{1}{2}$, $A=45°.00'$

“ “ 2, “ “ $\frac{1}{3}$, “ 54°14′

“ “ 3, “ “ $\frac{1}{4}$, “ 60°00′

“ “ 4, “ “ $\frac{1}{5}$, “ 63°26′

&c. &c. &c.

Now if K*c* be drawn and KO taken as radius K*c* will be sine of angle KOC, and cosine of KCO, the angle of emergence at C; also if KO be put equal to 1, KM will numerically be equal to the square of that cosine and will equal half the radius, and so will exactly equal the value of the cosine in the first line of above table; the geometrical and algebraical processes giving of course the same result. In like manner, if K*e* be drawn, K*e* will be the cosine of angle of emergence at E, to same radius, and KR will be the square of that cosine; the calculus shows above in second line of table, that when $n=2$, that is, when law supposed is the inverse square of the distance, then $\cos^2 A=\frac{1}{3}$; and this was the value used for KR, in order to find the point *e*, then E and *q*, and lastly the line Q*q*. Proceed in like manner for the other values of *n*.

AUGUST 25TH, 1887.

The President in the Chair.

The following papers were read:

NOTE ON PIERIS RAPÆ.

BY PROF. LEWIS R. GIBBES.

The European Cabbage Butterfly, *Pieris rapæ*, made its appearance in Canada and the Northern States, more than twenty years ago, and has since been spreading westerly and southerly in the United States. In October last, Mr. S. H. Scudder of Cambridge, Mass., who has been studying the progress of the new comer through our country, sent me a card of queries, relative to its appearance in this neighborhood, and from my letter in reply to his queries I make the following extracts, which I lay before the Society, as some contribution to the natural history of this State, with respect to the range of this lepidopter, and of a few others.

"The year 1870 was remarkable for the number of *Lepidoptera* to be seen in Charleston, and also for the variety of species present. In that year I took three individuals of *Libythea* never seen by me before or since. Among all these species, I saw no *P. rapæ* although I was not unacquainted with its appearance, having fortunately at hand, a few English specimens, and also English figures and descriptions in *Jardine's Naturalists' Library*. In 1873, I observed them as not uncommon in this City, and recognized them at once while flying, as distinct from their congeners, *P. monusta* and *P. protodice*, both of which I have taken in this City. Now supposing the early broods of 1873 to have been produced from eggs of the preceding year, or that the insect had already appeared in the surrounding country, before I had observed it in this City, my only region for observation, I think we may fix 1872 as the year of its appearance in this vicinity, without an error of more than one year, earlier or later. I have seen it, I think every year since, more abundantly in some than in others, either because my attention was then more directed towards them, or because as in 1870, some years were more productive, if not of animal life in general, at least of species and individuals of *Lepidoptera*. As to your third query I fear the little I have given you is all that you will get; I know of no one in this State, who takes any interest in these matters, though there may be such; and as to opportunities for publishing, there may be said to have been none.

* * * * * * In 1876, on 16th April, I saw a caterpillar enveloping itself for its chrysalis state; the next day when it had completed its work, hanging from the underside of the sill of a window of one of the outbuildings near our College, I cut off the strip of wood to which it was attached, with chisel and mallet, carried it indoors, and suspended it in a glass vessel. Imago appeared on 2d of May, and to my surprise proved to be *Vanessa antiopa*, which I had considered as wholly northern. In April, 1879, I took a single individual in the suburbs, the only other I have seen. I suppose it may be considered southern but rare. In 1885, a relative sent me from Beaufort, S. C., what was considered "a strange butterfly". On opening the letter I recognized it immediately as *Heliconia charitonia*, which I had never before seen. Have you heard of its being taken so far north before?"

In Mr. Scudder's last letter to me, of the 8th inst., he says that his paper is in type, but not yet published, and sends me the manuscript of that portion relating to the spread of *P. rapæ* in the southern states; he also sends a copy of the map, to accompany his paper, showing the centres and areas of distribution of *P. rapæ*, from 1860 to 1886. These I lay on the table for the inspection of our members. Mr. S. regards Charleston as one of the centres of distribution, the insect not having come to the City from the surrounding country, as I had supposed, but brought hither by some coasting vessel.

A portable and easily made Heliotrope.

BY PROF. LEWIS R. GIBBES.

A *Heliotrope* is an instrument by which the course of the sun's rays may be so changed by the experimenter, as to be directed with certainty to a given point at the distance of several miles. It may be made to subserve two important purposes; first, that of making known at the given point the position or station of the experimenter, which it is necessary to do in a trigonometrical survey; secondly, to convey information from the experimenter to the given point, by successive interruptions of the ray, when once accurately directed, each interruption lasting but a short interval of time. Instead of interrupting a fixed ray, the ray may be thrown upon the given point at intervals, forming successive flashes of light, and in each of these methods an alphabet, corresponding to that of Morse, may be used, short and long flashes or interruptions corresponding to the dot and dash of Morse. The art of thus communicating a knowledge of the position of the experimenter, or of his thought, has been called *Heliography*, and the instrment is sometimes called a *Heliograph*.

Several forms of this instrument have been contrived by different authors. One method, tolerably obvious and easy to comprehend is this: Place two stands or supports, A and B, a few feet apart, in a line with the distant given point, B being nearest to that point. Let each stand carry a screen one foot square, each having a circular hole 3 or 4 inches in diameter cut in the middle of it, that on B being a little smaller than the other; the screens being so arranged that on looking through them from A to B, the given distant point may appear to occupy the centres of each of the apertures A and B at thesame time. Then if with a common hand mirror, a beam of sunlight be reflected through A to B, the smaller, so as to form a circular ring of light around the edge of B and concentric with it, it will be evident that the rest of the beam which passes through B, will be properly directed to the distant point. Such a beam is easily visible in good weather 50 or 60 miles or even more.

We can now obtain a second and more compact form of Heliotrope, by supposing a pair of screens, similar to those above but smaller, to be attached to the tube of a telescope, with the centres of their apertures carefully adjusted to be in a line parallel to the optical axis of the telescope; a small mirror, movable about two axes at right angles to each other, being also attached to the tube of the telescope, near the eye-end to reflect the light through the apertures. When the distant point is seen through the telescope in the centre of the field of view the beam sent through the two apertures will be accurately sent to the distant point.

Instruments of each of these forms have long been in use, with some additional modifications for greater convenience of manipulation; the former in the geodetic surveys of the English service, and the latter in those of the United States.

Several forms of Heliotropes have been devised by Drummond, Struve, Gauss, Steinheil, Galton and Miller, each based upon some ingenious application of optical principles; of these I can speak definitely only of the first and of the last two. Although I know where the original descriptions of the other instruments are to be found, the works themselves are inaccessible to me, nor have I yet been able to find the desired information in those works that are accessible. Under article *Heliotrope* in the ninth edition of the *Encyclopedia Britannica*, are described the plant and the mineral bearing that name, but no allusion is made to the instrument. Under *Heliography*, instruments are described similar to the first of the above mentioned, including modifications applied to those in use in the English surveys. No mention is made of the writers whose names I have given above, no notice is taken of their inventions.

Drummond's apparatus, described in the *Philosophical Transactions* for 1826, consists of two telescopes and a mirror, the three so arranged and connected by jointed bars, that when one telescope is directed to the sun, and the other to the distant point, the sun's light is then accurately reflected by the mirror to that point.

Struve's instrument is in principle the same as the second one I have described above.

Gauss invented two such instruments, and one of his contrivances is said to enable the experimenter to use the sextant as a heliotrope. Let us suppose that a third mirror were added to the sextant or octant, and firmly attached to the index mirror, their reflecting surfaces forming with each other a suitable fixed angle, easily determinable in the case of each instrument. This proper fixed angle between the two index mirrors is equal to half the angle between a ray, from the index mirror, incident on the horizon mirror and its reflected ray going to the eye. It is not difficult to see that if one now goes through the well known operation of measuring the angular distance between the centre of the sun, and the given distant point, the third mirror will reflect the sun's rays directly to that point, so long as we keep the image of the sun in apparent coincidence with that point seen in the centre of the field of view of the telescope of the sextant. The range of application of this form of heliotrope would be limited by the length of the arc of the octant or sextant; a reflecting circle or some similar instrument would give a greater range. Whether the device here proposed be precisely the one adopted by Gauss, I am unable to say. This sextant-heliotrope seems to be the first portable one that was invented.*

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* By a *portable* instrument is here meant one which does not *require* a fixed stand or support, but may be put to use supported only by the hands of the experimenter.

With the construction of the other heliotrope contrived by Gauss, I am not acquainted, nor do I know the form of Steinheil's, except that neither was portable.

The heliotropes of Francis Galton and of William Hallows Miller, (the mineralogist,) are very portable, and depend upon the same optical principle as that used in Gauss's sextant-heliotrope, though they differ widely in the methods by which that principle is carried into effect. The optical principle required, or problem to be solved is this: to cause two rays proceeding from the sun, finally to travel in opposite directions, along two lines parallel and very near to each other. Mr. Galton effects this by causing some of the rays proceeding from the reflecting mirror to pass through one half of a lens, by which an image of the sun is formed on a surface placed at the focus of the lens; this image is then viewed by the eye of the observer behind the same lens, and the direction of the motion of the light in passing from the second half of the lens to the eye is exactly opposite and parallel to that of the light in passing from the mirror to the first half of the lens; and these last rays are part of those intended to be sent from the mirror to the given distant point. If then we so manipulate the instrument that the rays proceeding from that image of the sun through the lens to the eye seem to proceed from the given distant point, then will the rays reflected by the mirror, proceed accurately to that point.

My construction of this instrument is very simple, a strip of wood 10 or 12 inches long, $\frac{3}{4}$ inch wide, and $\frac{1}{4}$ inch thick, carries at one end a wooden peg with flat surface to receive the sun's image. A common lens, (of the kind used for cheap spectacles,) of 6 or 8 inches focus, is carried by a small brass clamp nailed to the strip, at a distance from the peg, equal to the focal length of the lens. Behind the lens is a small bit of mirror glass clamped in a piece of wood, which is attached to the longer strip by a single screw about which it is movable friction-tight, as on a pivot. To manipulate it: point the long strip towards the given distant point, supposed to be in the horizon, turn the strip about its longitudinal axis, until its upper surface, if prolonged, would pass through the sun; then move the mirror around its pivot until the sun's rays pass through one half of the lens and form its image on the peg; then apply the eye to the other half of the lens, and view the image with one half of the pupil of the eye whilst the other half of the pupil views the given distant point; make the image apparently cover that point, and it will then receive the rays reflected from the mirror. By the use of the smaller of the two instruments before you, I have received *flashes* from my son, at the summit of a mountain nearly three miles distant; the focal length of lens is 7 inches, and area of mirror less than 6 square inches. With the larger instrument now on the table, lens of 15 inches focus, and 28 square inches area of mirror, held in the hand, I have sent flashes from Pendleton, S. C., which were easily seen at the house of Mr. S. P. Ravenel, near Highlands, N. C., a distance of 25 or 30 miles. As the mirror is oblique to the reflected rays the visual area is always less than the actual area of the mirror.

Mr. Miller's heliotrope requires that three pieces of plate glass (clean sextant horizon glasses answer very well,) should be cemented together, the reflecting surface of each being perpendicular to that of each of the others. It may be shown that the light from the sun, reflected successively from two of these plates, and passing through the third, will be moving parallel with, but opposite to the motion of the light reflected from this third surface, and so will the problem above be solved. I have constructed such an instrument and used it successfully for short distances, but have not tried it for long ones, as there will be uncertainty about the accuracy of the angles, unless carefully tested or measured. This instrument is more compact than any of the others, and might consist of a single piece of plate glass, as Mr. Miller has shown, by having two additional planes ground at one of its corners, and carefully polished, so as to have three planes accurately placed at right angles to each other.

The last two instruments are, as has been shown, eminently portable, but nothing forbids their being mounted on stands when convenient to do so, as in making use of the Morse alphabet.

Of all these instruments, Galton's is the easiest to construct, and requires the fewest adjustments, as is evident from the instruments I have now exhibited.

SEPTEMBER 29TH, 1887.

The President in the Chair.

Books Received.

Naturforschenden Gesellschaft, Görlitz: Abhandlungen, Band XIX.

Royal Society, Dublin: Scientific Transactions, Series II, Vol. III, parts 11–13, and Vol. V, parts 3–6.

Museo Nacional de México: Anales, Tomo 3, Entr. 11.

Smithsonian Institution: Report, 1885, Part I.

Museum of Comparative Zoology, Cambridge: Bulletin, Vol. XIII, No. 4.

Royal Society, London: Proceedings, Nos. 255–6.

American Philosophical Society, Philadelphia: Proceedings, Vol. XXIV, No. 125.

Academy of Sciences, St. Louis: Transactions, Vol. IV, No. 4.

California Academy of Sciences: Bulletin, Vol. II, No. 7.

Dr. J. F. Churchill's Free Stæchiological Dispensary: Reports 1 and 2.

Mr. E. A. Smyth, Jr., exhibited specimens of *Geothlypis trichas*,

Dr. Manigault exhibited a fossil upper jaw of a Dugong, from Cainhoy, S. C.,* and several beautiful glass models of lower forms of Marine Invertebrates.

The Chairman exhibited a model showing the principle of Miller's form of Heliotrope, mentioned by him at the meeting of August 25th.

Mr. Smyth, referring to the specimens exhibited by him, stated that it is a recognized fact among many of our migratory birds, and especially among the Warblers, that the males and females migrate separately.

On the night of Sept. 23d, immediately following a cold wave, our City was invaded by a large number of Warblers, described by the newspaper as "about the size of Canaries, * * * having brown backs and yellow breasts." many were killed by striking against the electric lights.

Mr. Smythe was fortunate enough to see several examples, both dead and alive, all of which were Maryland Yellow-throats, (*Geothlypis trichas,*) and all females. Those who had seen the birds and whom he was able to question were positive in their description, which agreed with the vague description given by the paper, and no one was able to recollect having seen any black about the heads of the birds. As the black on the head of the male Yellow-throat is a most noticeable feature, and as all of the examples that came under his own observation were females, he felt justified in concluding that the flight was composed wholly, or nearly so, of females. The birds seemed very much exhausted or frightened, and some were caught by hand.

The following paper was read:

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* See page 91.

Published Mch., 1888.

Note on the usual methods of demonstrating the arithmetical rule for finding The Area of a Triangle when the three sides are given.

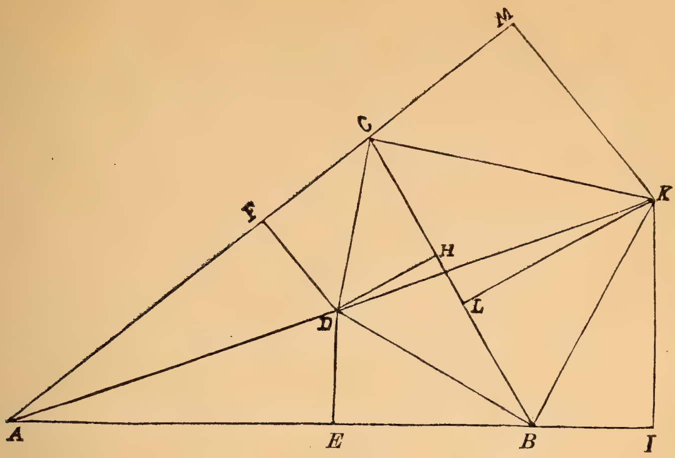
BY PROF. LEWIS R. GIBBES.

THE well known arithmetical rule for the solution of this problem is as follows: Find the sum of the three given sides, and take its half; from this half sum take each of the sides successively, obtaining three remainders; take these three remainders and the half sum as four factors, and find their continued product; take the square root of this product, and the result will be the area of the given triangle, in square units of that kind used in expressing the lengths of the sides.

One hardly seems warranted in bringing forward for discussion a subject so trite as this, presented in every text book on mensuration and surveying, and even in many on arithmetic; but in none of the text books on geometry known to us, at present in use, can we find a *geometrical* demonstration of the theorem on which this rule is based. It is usually demonstrated *analytically*, either in the body of the work or in an appendix, by the application of algebra to some of the geometrical theorems in the text, or else by the use of some trigonometrical theorems, given later in the course of instruction. It would seem but proper that a geometrical theorem should have a geometrical demonstration, and at least two such were to be found in elementary treatises published 70 years ago; one of these was given in the appendix to the American edition of *Legendre's Geometry*, in use 50 years since, but has been omitted in the later editions. Perhaps the complex form in which they originally appeared seemed too difficult for use in an elementary work on geometry, like that of Legendre or the many works based upon it, and the appearance, in the last mentioned one, of the ungeometrical phrase, "the square of the area," may have deterred editors from continuing the use of that demonstration. We shall endeavour to obviate these difficulties, by using the other, and breaking it up into several propositions, the demonstration of each being simple enough to form an easy step toward the required final one. We can lay no claim to novelty, nor even to originality, in the method employed in the following demonstrations, but only desire to facilitate the apprehension of the closing proposition, and so promote the introduction into geometrical treatises, of this geometrical demonstration of an important geometrical theorem.

1. Let ABC be the given triangle; draw AK, bisecting the angle A, and BD bisecting the angle B; from D, the intersection of these two bisectrices, draw the three perpendiculars, DE, DH, DF, one to each side thus dividing each side into two segments; lastly draw CD.

2. Next, prolong the sides AB, AC, the first forming an external angle at B, the second another external angle at C; draw the line BK, bisecting the external angle at B, and from K, the point where this bisectrix intersects the bisectrix AK, draw the three perpendiculars KI, KL, KM, one to each side; thus will



be limited three pairs of lines which may be called the *external segments* belonging to each side; KI giving AI and BI, belonging to side AB, KL giving BL and CL, belonging to BC, KM giving CM and AM belonging to CA; lastly draw line CK.

3. Prop. I. First, the three perpendiculars DE, DH, and DF, are equal to each other; secondly, the two segments AE and AF about angle A, are equal to each other, BE and BH about angle B are equal to each other, and CH and CF about angle C are equal to each other.

For, the triangles ADE and ADF have side AD common, and two angles in one respectively equal to two in the other, and hence DE=DF, and AE=AF; by like reasoning it may be shown by the triangles BDE and BDH that BH=BE, and DH=DE=DF. Lastly, in the triangles CDH and CDF, we have a right angle in each, the side CD common, and sides DH and DF equal; therefore CH=CF, and CD bisects the angle C.

Hence the perpendiculars DE, DH, DF, equal each other, the members of each pair of segments about any angle are equal to each other, and the three bisectrices have a common point D.

4. Prop. II. First, the three external perpendiculars KI, KL, KM, are also equal to each other; secondly, the two segments AI and AM about the angle A are equal to each other, BI and BL about angle B are equal to each other, and CL and CM about angle C are equal to each other.

For, the triangles AKI and AKM have side AK common, and two angles in one respectively equal to two in the other, and hence KI=KM and AI=AM; by like reasoning it may be shown in the triangles BKI and BKL that BI=BL, and KL=KI=KM. Lastly, in the triangles CKL and CKM, we have a right angle in each, the side CK common, and the sides KL and KM equal; therefore CM=CL and CK bisects the external angle at C.

Hence the perpendiculars KI, KL, KM, equal each other, the members of each pair of *external segments* about any angle are equal to each other, and the three bisectrices AK, BK, CK, have a common point K.

5. Prop. III. The segments BL and CH are equal, and consequently, also BH and CL are equal.

First, since AI=AM, and AE=AB, we have EI=FM; secondly, since BI and BE equal respectively BL and BH, we have EI=BL+BH=BL+BL+LH; thirdly, in like manner, since CF and CM equal respectively CH and CL, we have FM=CH+CL=CH+CH+LH; fourthly, by combining these results, we get BL+BL+LH=CH+CH+LH which shows that BL=CH, and therefore also that BH=CL.

6. Prop. IV. First, the line AI equals half the perimeter of the triangle ABC; secondly, BI is the difference between the half perimeter and the side AB; thirdly, BE is the difference between the half perimeter and side AC; fourthly, AE is the difference between the half-perimeter and side BC.

First, the perimeter is composed of the six segments already mentioned, forming three pairs, the members of each pair being equal to each other. Then if one member be taken from each pair, their sum will equal the half perimeter, and such is the constitution of the line AI, for AE is one of the pair at angle A, BE is one of the pair at angle B, and BI is equal to one of the pair at angle C.

Secondly, it is obvious that BI is the difference between the half perimeter AI and the side AB.

Thirdly, since BI=CF and AE=AF, so that AE+BI=CF+AF=side AC, therefore BE is the difference between the half perimeter AI and side AC.

Fourthly, since BE=BH and BI=CH, then EI=BC, and AE is the difference between the half perimeter AI and the side BC.

7. Prop. V. The right angled triangles BDE and BKI are similar, and the rectangle BE×BI=the rectangle DE×KI.

The angle CBI is the supplement of CBA, and therefore the angle KBI, which is half the first, must be the complement of DBE which is half the second. But EDB is also the complement of DBE, and is therefore equal to KBI. Then the triangles having two angles in one respectively equal to two angles in the other are similar, and, DE : EB :: BI : KI and the rectangle BE×BI= the rectangle DE×KI.

8. Prop. VI. The area of ABC equals the rectangle AI×ED.

For the area of ABC is equal to the sum of the areas of the triangles ABD, BCD and CAD, which have altitudes equal to ED. Hence the area ABC equals half the sum of the bases of these triangles upon their common altitude and therefore equals half the perimeter upon the common altitude, or area ABC equal the rectangle AI×ED.

9. Prop. VII. The area of triangle ABC is a mean proportional between the areas of two rectangles, the sides of the one being AE and AI, those of the other BE and BI.

The triangles AED and AIK are similar, and we get AE : ED :: AI : IK. Taking first and second terms of the proportion as bases, form rectangles by using third term as altitude; taking third and fourth terms as bases form rectangles by using second term as altitude, which alters not the proportionality, and get AI×AE : AI×ED :: AI×ED : KI×ED. But by Prop. VI, each of these means is equal to the area ABC ,and by Prop. V the last term KI×ED equals BE×BI, substituting these quantities in last proportion, we shall have rectangle AI×AE : area ABC :: area ABC : rectangle BE×BI, which proves the proposition.

The above porportion expressed in numbers leads to the usual arithmetical rule.

10. The first term of the final proposition given above, is the rectangle AI×AE, AI being the half-perimeter, and AE the difference between that half-perimeter and the base BC, or side opposite to vertex A, of the angle which had been bisected by the line AK. The last term is the rectangle BE×BI ; BE being the difference between the half-perimeter and side AC, one of the sides about the angle A, BI being the difference between the half-perimeter and side AB, the other side about the angle A. Hence it will be evident that if we bisect angle B by a line which we may call BDK′, the first term of the final proportion will be the rectangle AI×BE, and the last term will be AE×BI ; also that if we bisect angle C by a line, which we may call CDK″ that the first and last terms of the final proportion will be AI×BI and AE×EB. Therefore three pairs of rectangles can be found, between the members of each of which the area ABC is a mean proportional.

The points D, K, K′, and K″ are well known as the centres of the *inscribed* and of the three *escribed* circles, but as no property of the circle is used in the demonstration, it is not necessary to draw those circles.

11. The preceding demonstration may be regarded as complete, as we have only assumed that the reader is acquainted with the simplest theorems relating to equality of triangles, to ratios and proportions, and to the proportionality of similar triangles ; if introduced into a course, the above propositions could be placed among the propositions of Legendre's fourth Book.

12. Although none of the circles above mentioned were required in the preceding demonstrations, we add the following known propositions relating to their radii, as they are closely connected with our subject.

Prop. VIII. The area of a triangle is equal to that of the rectangle formed by the radius of the inscribed circle and the half-perimeter.

This is evident from Prop. VI, which shows that the area is equal to AI×ED ; for AI is the half-perimeter, and DE is one of the three equal perpendiculars DE, DH, and DF, and is therefore the radius of the inscribed circle.

Prop. IX. The area of a triangle is also equal to that of the rectangle formed by the radius of one of the escribed circles, and the line which is the difference between the half-perimeter and that side which is tangent to that escribed circle.

For by the diagram, AE : DE :: AI : KI ; whence the rectangle DE×AI equals rectangle KI×AE. By last proposition the first rectangle DE×AI equals area of triangle. In the second rectangle, KI is, by Prop, II. one of the three equal external perpendiculars, KI, KL, and KM, and is therefore the radius of the escribed circle which, at L touches the side BC, at I touches the side AB prolonged, and at M touches the side AC prolonged. Also in this second rectangle, AE is, by Prop. IV, the difference between the half-perimeter and the side BC, which is tangent to the escribed circle whose centre is K.

13. PROP. X. If a rectangular parallelopipedon be formed by taking the three sides of any triangle as the three edges of one of its solid angles, and if a right triangular prism be formed, having that triangle for its base, and having for its height twice the diameter of circle circumscribing that triangle; then will the volumes of the parallelopipedon and of the prism be equal.

By a well known theorem of Legendre's fourth Book, (American edition,) the area of the rectangle formed by any two sides of a triangle, as AB×AC, equals that of the rectangle formed by the diameter of the circumscribing circle, and the perpendicular from the vertex A, on the remaining side BC; put AP for this perpendicular, and AR for the diameter, then rectangle AB×AC=rectangle AR×AP.

If now we take rectangle AB×AC as the base of a rectangular parallelopipedon, and the remaining side BC as its height, we shall have the parallelopipedon AB×AC×BC, given in enunciation above; and if we take rectangle AR×AP as the base of a right rectangular prism, and the side BC as its height also, we shall have the prism AR×AP×BC, and the volume of the prism will equal that of the parallelopipedon, since they have equal bases and equal heights.

But the prism may also be regarded as having AR for its height, and the rectangle AP×BC for its base, and as this base is evidently double the area of the triangle, it follows that if we form a right triangular prism, whose base is the given triangle ABC, and its height equal to twice AR, its volume equals that of the right rectangular prism, since its base is half that of the last and its height is double that of the last.

The triangular prism is therefore equal to the parallelopipedon, which was to be proved.

14. The *numerical* results derivable from the preceding propositions may be expressed algebraically thus: Let

$a, b, c,$ =the sides opposite to the angles A, B, C, respectively.
$s=\frac{1}{2}(a+b+c)$=the half-perimeter.
t=the area of the triangle, ABC.
r=the radius of the *inscribed* circle.
$r', r'', r''',$=the radii of the three *escribed* circles, touching externally respectively, the sides a, b, c.
R=the radius of the *circumscribed* circle.
$p, p', p'',$=perpendiculars from angles on sides $a, b, c,$ respectively.

Then, from what has been demonstrated, we can derive the following equations applicable to the *numerical* values of the symbols, in any given case:

$$t^2=s(s-a)(s-b)(s-c) \qquad (1)$$

$$t=rs=r'(s-a)=r''(s-b)=r'''(s-c)=\frac{abc}{4R} \qquad (2)$$

$$2t=pa=p'b=p''c \qquad (3)$$

The numerical value of the sides being given the area t may be obtained from equation 1, then the five radii from the equations marked 2, and the three perpendiculars from equations 3. From equations 1 and 2 may easily be derived, *algebraically*, the following equation 4:

$$t^2=rr'r''r''' \qquad (4)$$

This shows that these four radii can form three pairs of rectangles, between the members of each of which pairs, the area of the triangle is a mean proportional.

15. To render more complete the present view of our subject, we venture to add the following equations, in order to find any one of the perpendiculars as p, when a, b, and c are given without first finding the area.

The perpendicular p falls on the side a and divides it into two segments, whose *sum* constitutes the side a, and whose difference we will call d. As p divides the triangle into two right angled triangles, we can, by the use of the well known theorem applicable to such triangles, easily show that

$$d=\frac{b^2-c^2}{a} \qquad (5), \text{ supposing } b \text{ greater than } c;$$

$$\text{then } p^2=b^2-\frac{(a+d)^2}{4}=c^2-\frac{(a-d)^2}{4} \qquad (6)$$

Find d by equation 5 and then p by each of equations 6; the agreement of the resulting numbers will be a check or test of their accuracy.

16. Lastly, if we now find t by first of equations 3, we may then find the radii, r, r', r'', r''', by equations 2, which will complete our view of this subject.

OCTOBER 27TH, 1887.

The President in the Chair.

Books Received.

Koninklijke Akademie van Wetenschappen, Amsterdam: Verslagen en Mededeelingen, Afd. Naturkunde, III Reeks, Deel 1; Afd. Letterkunde, III Reeks, Deel 3.

Koninklijke Akademie Disciplinarum Neerlandica: Judas Machabaeus, &c.

Royal Society, London: Proceedings, No. 257.

New York State Library: Report, 1886.

Museum of Comparative Zoology, Cambridge: Bulletin, Vol. XIII, No. 5; Memoirs, Vol. XVI, Nos. 1 and 2.

Mr. E. A. Smyth, Jr., exhibited specimens of *Parus Carolinensis* and *P. atri-capillus.*

Mr. Smyth made the following remarks concerning the birds exhibited by him:

There is a noticeable difference in size between several Northern and Southern birds of the same species, which is constant enough to warrant a special varietal name, and in some instances the difference is so marked as to make a different specific name seem appropriate.

Of the former class might be cited the Barred Owl, *Syrnium nebulosum*, and its smaller Southern form, *Syrnium nebulosum Alleni*; the Red-shouldered Hawk, which is represented in the Gulf States by a smaller form; the Florida Quail; Audubon's Woodpecker, which is a small, dark, Southern form of *Picus villosus*; and others.

Of the latter class are the specimens exhibited to the Society to-night, namely, *Parus atri-capillus*, the Black-capped Chickadee, of the Northern States, and *Parus Carolinensis*, the prevailing Southern form.

It seems that these two species can but be merely geographical forms of one species, but they never overlap each other's boundaries, and the difference in size — something over an inch, a large amount in so small a bird, — is so constant, that the one can certainly be considered at least a sub-species of the other. The specimens of *P. atri-capillus* were obtained in Princeton, N. J., in mid-winter, and those of *P. Carolinensis* in Clarenden Co., S. C., in October; in Anderson Co., S. C., in February; and in Jefferson Co., Ala., in November.

It would be interesting to enter into a discussion as to the probable cause of these geographical differences; why the Southern forms are smaller and darker than the Northern, and the Western forms paler than the Eastern, but for the present, the object is merely to show by actual comparison that there is such difference.

In connection with his remarks made at the September meeting in regard to *Geothlypis trichas*, Mr. Smyth said that on October 5th, after a cold snap, he had seen in his garden in Legare' Street, a number of Maryland Yellow-throats, the majority of which were males, and at and immediately before this date both sexes were plentiful, in the country around the City. On this same day, Oct. 5th, he also saw in his garden a Golden Crowned Thrush, (*Seiurus aurocapillus*) and four specimens of *Dendrœca cerulescens*, which latter he was much surprised to see, as it seldom ventures out of the swamp lands while with us in its migrations. In company with these were also a Black and White Creeper, and two female Redstarts. A list of the birds which he has collected in his own garden, in the heart of the City, which he is preparing, shows a remarkable variety of woodland and swamp birds that would hardly be thought to be found in a City.

The Chairman read the first part of a paper on "The Annular Phase of Venus."

A communication from the Smithsonian Institution was read announcing the death of Prof. S. F. Baird.

34TH ANNIVERSARY MEETING.

NOVEMBER 17TH, 1887.

The President in the Chair.

Books Received.

Royal Society, London: Proceedings, No. 258.
Museo Nacional de México: Anales, Tomo IV, Entr. 1.
Kaiserliche Leopoldina Carolina Deutsche Academie der Naturforscher, Halle:
  Zeising, Der goldene Schnitt.
  Schreiber, Barometerstände.
  Dewitz, Westafrikanische Tagschmetterlinge.
  Triebel, Wurzeln von Compositen.
  Knoblauch, Verhalten der Wärme gegen Metalle.
  Gerland, Zur Geschichte der Physic.
  Prowe, Copernicus als Arzt.
  Engler, Ozon.
Oberhessiche Gesellschaft für Natur- und Heilkunde, Giessen: 25ter bericht.

The following Officers were elected:

Published Apl., 1888.

President.

LEWIS R. GIBBES.

Vice-Presidents.

J. P. CHAZAL, H. P. ARCHER.

Corresponding Secretary.

F. W. SCHLEPEGRELL,

Recording Secretary and Treasurer.

WM. G. MAZYCK.

Librarian.

G. E. MANIGAULT.

Curators.

F. W. Schlepegrell,
G. E. Manigault,
C. F. Panknin,
C. U. Shepard,
J. Guitéras,
Wm. G. Mazyck,
H. E. Shepherd,
C. B. Colson,
E. A. Smyth, Jr.
J. K. Blackman.

DECEMBER 22d, 1887.

The President in the Chair.

Books Received.

Elisha Mitchell Scientific Society, Chapel Hill, N. C.: Journal, 1887.

Museum of Comparative Zoology, Cambridge: Report, 1886--7.

Kaiserliche Akademie der Wissenschaften, Wein: Sitzungsberichte, 1886, I Abt., Heft 4--10; II Abt., Heft 3--10; III Abt., Heft 1--10. 1887, III Abt., Heft 1--2.

Académie des Sciences, Arts et Belles Lettres, Dijon: Memoirs.

Members Elected.

C. J. Colcock, F. H. Colcock.

JANUARY 26th, 1888.

The President in the Chair.

Books Received.

Royal Society, London: Proceedings, No. 259--60.

American Philosophical Society, Philadelphia: Proceedings, Vol. XXIV, No 126.

Society of Arts, London: Journal, Vol. 35.

Dr. Manigault exhibited a very fine fossil molar tooth of *Dorudon serratum*, Gibbes, from phosphate mines on Ashley River, S. C.

Dr. Manigault, speaking of the tooth exhibited by him, said that the animal to which it had belonged had been first described by Owen, who considered it a cetacean and called it *Zeuglodon*. Agassiz subsequently named it *Phocodon*, from its nearer affinity to the seals. It is now considered a link between the sperm whale, dolphin, &c., and the *Sirenia* (dugong and manatee).

The specimen is large and very fine, showing the serrations on the edges and the double root in a perfect manner.

Mr. Mazyck stated that on the occasion of the last earthquake shock, which occurred at 10.54 o'clock, A. M. on the 12th inst., he had been able to verify in a remarkable degree the opinion expressed by him in the notes which he had prepared for the use of the Commission appointed by the Society,* regarding the movement and course of the earth-wave. He was seated at the time in his office, on the second floor of the three story brick building, at the S.E. corner of King and Ann Streets, when the lifting of the N.W. angle of the building was plainly evident. The duration of the agitation was about 45 seconds, and its intensity was quite severe, about as much so as that of the shock which occurred on 10th April last, and sufficiently so to crack one of the tall chimnies of the S. C. Railway Co.'s workshops; to throw down books from shelves, &c., and in some places in the lower part of the City, to crack plastering. From the effects noted in his office, Mr. Mazyck is quite positive that the movement of the wave was as he had previously been led to believe. A smoke arrester, pendant from the chandelier above his desk, so suspended as to be capable of movement laterally in any direction, was set in violent motion on a line *from N. W. to S.E.*, which continued for 4 minutes and 12 seconds. A small book-case stands on the top of an iron safe near the S.E. wall of the room, its doors opening towards the N.W.; both it and the safe were *visibly* tilted towards the S.E. by the lifting of the building under the first impulse of the shock, and upon its settling after the passage of the wave the doors of the book-case were thrown partially open. The chair in which he was seated is furnished with casters and was moved slightly towards the S.E. The direction of movement was observed by members of his household at his residence in Montague St.

Dr. Charles U. Shepard, commenting upon Mr. Mazyck's remarks, said that in the early part of September, 1886, he had constructed an apparatus designed to show the direction of the seismic waves. It consisted of a round concave glass dish, about five inches in diameter and half an inch in depth, to whose sides were attached eight radiating, funnel-shaped, paper spouts, with the broad ends of the latter touching each other at the rim of the glass. The glass was supported on a firm stand; and was filled to the utmost with mercury until the centre of the fluid was raised very considerably above the level of the edge of the glass, and no further addition could be made without the discharge of some of the mercury over the rim and through the spouts into beaker glasses placed at and under the narrow ends of the spouts.

The apparatus was placed on a firm table on the ground floor of his house, (68 Meeting Street,) and the spouts directed respectively to the North, North-East, East, South-East, South, South-West, West, and North-West. It was sufficiently delicate to cause a discharge of some of the mercury through the spouts on the occurence of any considerable jarring of the floor of the room in which it was located — such as might be produced by heavy and violent walking thereon. But it failed to record the lesser earthquake shocks which occurred so frequently in the period from about the beginning of the second, to the end of the third week in September, with the exception of two more marked ones. He was not observing the instrument on either of these two occasions, but was able to inspect it very shortly thereafter and before the recurrence of any appreciable seismic disturbance.

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* See pages 132 and 151.

On the first occasion a small quantity of mercury was thrown into the South-East beaker glass. On the second, a very considerable quantity was thrown to the South-East, and a decidedly smaller amount to the North-West.

Dr. Shepard was so much discouraged by the failure of the apparatus to record the lesser shocks, as also by his inability to cause a suspended and loaded pencil to afford intelligible tracings on paper, that he gave up further experimentation and omitted to note the dates of the observations described.

The Chairman mentioned that the mercurial apparatus used by Dr. Shepard in his experiments was not novel, but that one similar to it has been employed in Italy for the same object and is there known as a "Cacciatore".

Mr. Smyth said that on the 30th of December, 1887, his friend, Mr. Henry Hunter, informed him that he had shot a pair of "Long-tailed Ducks", or "Old Squaws" in Charleston Harbor. But when he went to Mr. Hunter's to see the birds, he found that the cook had picked them; from the heads, which were shown him, he identified the birds, as, beyond a doubt, *Clangula hyemalis*, the "Old Squaw" of Northern waters. This bird, though common at the North, is of only occassional occurrence in Southern waters, and this is probably the first record of its having been taken so far South. Mr. Hunter was fortunately able to obtain another specimen on the 16th of January, a female, which is now in Mr. Smyth's collection. Mr. Hunter told him that he had shot a specimen of this Duck some three years ago, near the City, in fact that he had stood in his yard, which faces the water on South Battery, and killed the Duck, which was feeding near by.

Dr. Manigault stated that he had recently seen exposed for sale in the City Market, several specimens of the Gadwal Duck, *Chaulelasmus streperus*, a bird that seldom ranges as far South as the latitude of Charleston.

The following paper was read:

NOTES ON COLORATION IN STERNA MAXIMA.

BY ELLISON A. SMYTH, JR.

It not infrequently happens in the realm of Ornithological research, as well as in other branches of Science, that from a limited opportunity of observation and study of objects in their natural conditions and surroundings, traits and peculiarities which are individual exceptions. are, by the observer hastily concluded to be universal and diagnostic; while on the other hand. from the absence in a few cases of certain characteristics and habits, which peculiarities and habits a more thorough knowledge of the object in all its conditions, would show to be prevailing, a hasty deduction is drawn, and the exception is again taken for the rule. An Ornithologist cannot be too much upon his guard when denying or affirming the universality of a trait or habit which he may or may not have observed in his necessarily incomplete observations.

In correcting or supplying a want in any statement made by Dr. Elliott Coues, one must needs be certain of his ground. But as even the works of the great Audubon contain many errors which lesser and humbler writers than himself have corrected, so we do not consider that we are presuming too much in supplying an omission in the excellent monograph of the Terns, which Dr. Coues has embodied in his "*Birds of the North West*"; an omission which we do not find noticed or supplied by any of the numerous writers on such matters.

In distinguishing *Sterna maxima*, the Royal Tern, of our Eastern Waters, from *Sterna elegans*, a bird of the Western and South-Western coasts, Dr. Coues mentions several differences, notably of size and relative proportions, serving as guides in separating the two species, which much resemble each other in general appearance. He says — (*Birds of the North West*, p. 670,)— "The species — *Sterna maxima* — is liable to be confounded with only one other of North America — *Sterna galericulata*, of Lichtenstein — (*Sterna elegans*, of Gambel, which name now holds)— * * . The latter is considerably smaller, with the bill, though as long, or nearly so, much more slender, and differently shaped, with a different proportionate length of tarsus and toes, a *rich, rosy blush* in the breeding season, * * and even in a Winter specimen the rosy hue of the under parts is perceptible."

As he nowhere in his description of the Royal Tern makes mention of this last peculiarity, we are justified in concluding that he never observed it.

In the early part of October, 1884, we were collecting sea birds along the reef which extends Westward from Fort Sumter in Charleston Harbor, and which, at low tide rises like a small island above the water, and is commonly known among the fishermen as "Pelican Bank". This bar is of many acres in extent, of firm, hard sand, and affords a favorite resting place for large flocks of Gulls and Terns. The Curlew occasionally deigns to visit it, and hordes of bustling little Sandpipers claim it as their own under a title which is seldom questioned.

Sailing to windward of this bank, we gradually approached within easy range of a large flock composed mostly of Laughing Gulls and Royal Terns. Unsuspecting any murderous design, they allowed us to give them two barrels as they sat, and as they rose in wild confusion two more were poured into them, and we were pleased at picking up four Royal Terns, for they had been our special aim.

Upon examining the specimens we were surprised to find that the satiny throat and breast plumage was not of the pure, pearly white that we believed to be universal in this species. On the contrary, the throat, breast, and belly plumage, even to the vent, was suffused with a delicate, creamy, pink hue; an intangible color that seemed to float through the feathers without belonging to them. On raising the plumage, the color seemed mere intense, as though striving to hide among the roots of the feathers and yet flooding them with its tint: like ruby sunset rays tingeing a snow-white cloud mass until it shines with a borrowed lustre. The color was not the rosy tint described as belonging to the Elegant Tern, and which is most beautifully evident in the Roseate Tern. In this latter bird this color is so intense that in an October specimen in our cabinet, which, at this writing is over three years old, it is clearly evident. Nor was it the clayey color which the Black Skimmer in breeding plumage shows to such advantage. It was more of a salmon pink, deepest on the breast and suffusing the shafts of the wing primaries to their very extremities.

The specimens, three of which were females, and one male, were adult, and in perfect feather, save the tail of the male, which still lacked the full length of the outer feathers on one side. They were not prepared for two days, during which time the color remained apparently undimmed. But upon being made into skins, there was a sensible diminution, and at the end of a couple of weeks the color was barely perceptible. The specimens now show no signs whatever of having had any unusual coloration. In a specimen in full feather shot on Dec. 26th, 1887, there was scarcely a perceptible presence of the color, though the shafts of the wing primaries were as rosy as in the other specimens.

We have never had the chance of shooting the bird in the breeding season, and so are as yet unable to state the condition as to color in the nuptial plumage.

One constant factor in determining *Sterna maxima* from *Sterna elegans*, where extremes in size might cause confusion, lies in the relative lengths of the tarsi as compared with the middle toe and claw: We quote again from Dr. Coues: " * * the toes in *elegans* are considerably shorter, compared with the tarsus, than in *maxima*. In *maxima* the middle toe and claw are somewhat longer than the tarsus; in *elegans* the two are of about the same length. The tarsus of *maxima* but very slightly surpasses the middle toe without its claw; the tarsus of *elegans* is nearly a fourth of its own length longer than the middle toe without its claw." The smallest specimens of *S. maxima* will show also a relatively stouter bill and heavier proportions than *S. elegans*.

We append a table of the measurements of the four specimens of *S. maxima* above described, comparing them with measurements given by Dr. Coues of *S.*

		LENGTH OF BILL ALONG CULMEN.	DEPTH OF BILL AT BASE.	LENGTH OF			
				GONYS.	RAMI.	MIDDLE TOE AND CLAW.	TARSUS.
Sterna maxima.	1	2.50	0.70	1.10	1.65	1.45	1.30
	2	2.45	0.70	1.10	1.50	1.45	1.25
Our measurements.	3	2.50	0.65	1.10	1.60	1.45	1.25
	4	2.50	0.70	1.15	1.50	1.80	1.25
AVERAGE.		2.48	0.68	1.11	1.56	1.53	1.26
Dr. Coues' measurements. *Sterna elegans.*		2.60	0.50	1.40		1.15	1.25

elegans. This table shows the relative differences of proportions, the lengths being in inches and fractions thereof.

The Royal Tern is one of the commonest in our Harbor, in the sense, that, like the poor, it is always with us ; though in regard to the number of individuals to be seen at any one time, it cannot compete with the Least Tern, or with Wilson's Tern, or Forster's, during the migrations. But Winter, Spring, and Summer alike know the loud, harsh and not altogether unmusical cry of *S. maxima.* In the Autumn we have seen great numbers of them resting on the sand bars in our Harbor, especially the reefs near Fort Sumter and Castle Pinckney. They breed regularly on "Bird Keys," near Kiawah Island, and formerly bred on Long Island, North of Sullivan's. As far as our observation, which is necessarily very limited, extends, July seems the month when the eggs are in the greatest profusion, though we have no evidence to show that they have not an earlier brood, except that we have never seen the young in the month when we have seen the eggs. They lay two eggs, and sometimes three. There is no attempt at a nest, merely a hollow scooped in the sand. At one time on Bird Key about fifty eggs of this species were found, the nests being so close together that a circle of two yards radius would have contained them all.

Like all large birds, our Tern is very careful of himself, and is one of the first to take wing, on the approach of a suspicious character, from the miscellaneous assemblage of sea-birds that gather on the sand bars left bare at low tide. With an extent of wing of some forty-three inches, and a muscular power capable of exercising such a spread to the best advantage, his flight, though less airy than the Least Tern, is inferior in powerful elegance to none. We have seen *Sterna maxima* match himself against the Bald Eagle, and follow, harrassing him, for some distance ; and that, too, in December, a time when there was no excuse in the way of eggs or young, which serves to warrant such a display of courage even in the weakest bird.

Where the waves of the wild Atlantic, now mad with Winter frenzy, now soft and gentle in the Summer breeze, wash the white rimmed coast of our Southern islands, and the dark palmetto adds a tropical gleam to the landscape, there is the home of *Sterna maxima.* Our sea coast would indeed lack a charm if deprived of the coral beak and black and silver plumage of this King of the Terns.

FEBRUARY 23D, 1888.

The President in the Chair.

Books Received.

Academy of Natural Sciences, Davenport, Iowa: Proceedings and Reports, 20th Annual Meeting, Jan. 4, 1888;
Address of Pres. Chas. E. Harrison,
A. F. Chamberlain, The Catawba Language.
Museum of Comparative Zoology, Cambridge: Bulletin, Vol. XIII, No. 6.
Boston Society of Natural History: Memoirs, Vol. IV, Nos. 1–4.
Royal Society, London: Proceedings, No. 261.

MR. E. A. SMYTH Jr. mentioned that on the 28th of January, 1888, he had seen in the Charleston Market a pair of "Shoveller Ducks," *Spatula clypeata*, a male and a female, which had been killed on James Island.

DR. SHEPARD exhibited a specimen of Hilgenstock's Tetra-calcic phosphate which he had received from Germany through the kindness of Dr. W. D. Wamer, U. S. Consul at Cologne, Germany. It consisted of masses of grayish, translucent, tabular crystals, imbedded in the "Thomas" slag, from which it was not possible to entirely separate the quantities necessary for a satisfactory chemical examination.

After some general remarks on the subject of iron-ore slags, Dr. Shepard explained the importance which now attaches to the "Thomas" slag. This article, a side product obtained in the treatment in lime-lined Bessemer converters of pig-iron, rich in phosphorus, constitutes to-day an important factor in phosphatic manuring, being agriculturally applied in a finely ground state to the extent of several hundred thousand tons per annum, more especially in Germany. This enormous consumption is the best evidence of its agricultural value. Otherwise there exists considerable difference of opinion among chemists as to its eligibility. According to all previous opinion and experimentation, the solubility (and consequently, as is generally believed, the assimilability) of mineral and other manurial calcic phosphates is in direct proportion to the preponderance of their content of phosphoric acid — as compared with the content of lime. But it is claimed that in the new and artificial tetra-calcic phosphate as well as in the "Thomas" slag which contains it, is presented a chemical combination particularly susceptible of assimilation by plants, more so than the ordinary tri-calcic (or so-called "Bone") phosphate or indeed than many of the partially hydrated and intermediate compounds standing between the bi- and tri-calcic phosphates. According to its chemical combination the tetracalcic phosphate should consist of:

Phosphoric Acid, . . .	38.4 per cent.
Lime, ...	61.6 "

and, according to the representations of Dr. Paul Wagner and others, it should be readily taken up by an aqueous solution of citrate of ammonia — the usual solvent employed for the estimation of that phosphoric acid which is insoluble in water, but is regarded as "available" for the nourishment of plants.

The specimen exhibited by Dr. Shepard, yielded on its examination in his laboratory, 33.45 per cent. of phosphoric acid, of which only slightly more than one-third was soluble in neutral citrate of ammonia when subjected to the method prescribed by the Association of Official Agricultural Chemists.

As an illustration of the discrepancy of opinion in regard to the value of the ground "Thomas" slag (very probably the result of essentially different material operated upon), the following quotations may be made from the reports of two of the leading agricultural experimental stations of the New England States, *viz:*

	I.	II.
Phosphoric acid soluble in citrate of ammonia,	19.57 per cent.	0.19 per cent.

According to Dr. Shepard's experience, the finely ground "Thomas" slag yields to the neutral solution of citrate of ammonia 5 to 7 per cent. of phosphoric acid, which is not much more than is afforded by the best grades of South Carolina phosphate dust (actual "floats").

MARCH 22D, 1888.

The President in the Chair.

Books Received.

Royal Society, London: Proceedings, No. 262.

Museum of Comparative Zoology, Cambridge: Bulletin, Vol. XIII, No. 7, and Memoirs, Vol. XV.

West American Scientist, San Diego, Cal.: Vol. IV, Nos. 32 and 33.

New York State Library: Report, 1887.

Mr. E. A. Smyth, Jr., exhibited specimens of two native species of *Mantis*, *M. Carolinensis* and *M. sps.?*

Mr. Mazyck read the following letter:

Charleston, S. C., March 16th, 1888.

Mr. Mazyck,

Dear Sir:

Two or three Summers ago whilst in my yard in Trumbo Court, I heard the cry of what I supposed to be, a small bird. It evidently was a cry of pain, and came from a honey-suckle vine in the garden near which I was standing. On approaching the vine, I saw a humming-bird fluttering and crying, but apparently somehow entangled. My approach possibly caused an extra effort on the part of the little creature, for it suddenly darted away. Supposing that it had been caught in some threads that were hanging upon the vine, or in a spider's web, I paid no more attention to the circumstance.

Two or three days after, however, I heard the same cry coming apparently from the same place. I could not, at the moment, lay aside the work that I was engaged in, so that fully two or three minutes elapsed before I could investigate matters. At length on reaching the vine, I saw the same little creature, (I presume it was the same,) struggling violently but unable to extricate itself. Touched by its piteous cry I rushed to its assistance and took it in my hands. To my astonishment I found it in the clutches of what in my boyish days was called a "Johnny-cock-horse". The color of the insect (it was grey) presenting so little contrast to that of the dusty vine stem to which it was clinging, prevented me from seeing it until I was close upon it. I took the little bird quickly into the house, and procuring a wide mouthed phial, returned and captured the "Johnny".

I knew that this insect was known to science by a more dignified name, which however had escaped my memory, and in searching for some description of the animal, I found its name — *Mantis* — and at the same time learned that in South America this creature is strong enough to capture, and bloodthirsty enough to destroy small birds.

This bird was wounded under the wing, upon one side of the breast, which had evidently been lacerated with the powerful mandibles of its captor. The wound looked ugly enough to lead me to fear that it would prove fatal, nevertheless my children and I cared for it as tenderly as we knew how, but we found it difficult to administer nourishment to a humming-bird. So at night I placed it among the leaves of the vine, — for it was a warm night, — and in the morning the little sufferer lay dead on the ground beneath.

Now, I must confess, a revengeful feeling against the Mantis entered my heart, so I chloroformed him. When I thought him dead enough, I unbottled him, and, with almost a naturalist's enthusiasm, I spread him out, and found much to admire, both in what I *could* understand, and in what I *could not* understand. I then placed him aside for a possible dissection next morning, but the next morning discovered the Mantis slowly recovering vitality, and I then determined to assist it in its struggle for life. During the day it was able to take with apparent relish a fly or two and several mosquitos, and to drink a drop of water suspended from the wire gauze cover under which it had been placed. But in a day or two it refused nourishment and began gradually to droop, so I placed it upon the vine and do not know what eventually became of it.

Now I should be pleased to know from yourself or any of your brother naturalists, if this species of Mantis, not more than two and a half inches in length, and quite common in this latitude, has ever before been known to actually seize, and firmly hold a bird on the wing. The humming-bird, it is true, is very small, but the muscles of its wings must be quite powerful, as evinced by its ability to *dart* swiftly away from that almost motionless posture which it maintains by the rapid vibration of its wings as it poises itself near the flower holding its food.

I should like also to have your opinion as to the possibility of maintaining the humming-bird in a state of captivity. Is it not necessary that it should be always upon the wing in taking its food, which may be either the honied secretions of, or the insects found *in* flowers?

I have intruded longer than I intended upon your patience. Perhaps if I were more of a naturalist I could put my questions in a more interesting form, as it is, I thank you for even reading them.

Respectfully Yours,

G. W. ALEXANDER.

MR. MAZYCK explained that Mr. Alexander having recently mentioned to him that he had witnessed the capture of a humming-bird by a mantis, he had suggested that a written statement of the occurence should be made for record in the Proceedings of this Society, this letter, therefore, although addressed to him personally, was intended as a communication to the Society, and he asked that it should be so considered.

The letter was referred to Mr. Smyth for reply.

The following paper was read:

History of the Mill Pond Oyster and Cause of its Disappearance.

BY C. BUNTING COLSON, M. D.

STUDENTS of Natural History have paid no mean attention to the Mollusk in comparison with the other branches of the Animal Kingdom. The habits, anatomy, and functions of the several varieties of this sub-kingdom, have been almost exhaustively investigated, and the common Oyster has been most particularly studied on account of its great economic value.

These studies or researches, with few exceptions, have, however, been of the Oyster in its natural bed ; my purpose is to study it out of its natural bed, and note the changes and conditions necessary for its culture and development. At the present time a large proportion of the vast amount of this bivalve consumed by man, has been either transplanted, or propagated in new waters and beds. In the following history of the Mill Pond Oyster, the necessity for knowing the habits and requirements of the Oyster, when placed in a new position or surroundings, will be perceived.

On the East bank of the Ashley River and bordering the entire Western shore of the City of Charleston, are several large ponds, called Mill Ponds, or latterly Oyster Ponds ; they vary from about 30 acres to near 1000 acres in extent, and were formed by damming in the low marsh flats in reach of the tides for the use of the saw-mills. The water was allowed to flow in them at the rise of the tide through a sluice or flood-gate opening on the river, which was lowered or closed as the tide ebbed, and thus a head of water of from two to three feet was detained, this was allowed to flow back gradually through a sluice to turn a water-wheel from which the saw mills received their power. This water was taken twice a day, at each flood of the tide. These ponds were also used to float the logs for the mills and were generally quite full of heavy timber. Very shortly after they were made it was noticed that the Oyster thrived and developed in them to an excellent condition, and in a few years the ponds were vast beds of Oysters which seemed inexhaustible, as each year they reproduced their kind in abundance.

I would mention for the information of those who were not fortunate enough to be familiar with this special variety of Oyster, that it was considered the finest type grown in Southern waters. Their flavor was desired by the epicure, their size was enormous, they were fat, yellow and most inviting, and the shell externally was as black as jet, and internally was a pure white, spotless pearl.

The owners of these ponds were all wealthy, and the Oysters were seldom sold and fortunate was he deemed who received a bushel or a dozen. The ponds were guarded at night to prevent theft. The Mill Pond Oyster was renowned — to-day it is a thing of the past.

In my study of this Oyster and the cause of its disappearance, which was owing to a mechanical condition, it has been interesting to note the physiological changes the Oyster must undergo to grow and develop in a mill pond.

From 1830 to 1869, the saw mills working by water power from these ponds were in full operation, and during this period the Mill Pond Oyster was at its best, but as the steam engine took the place of the water-wheel, it was no longer necessary to use the ponds except to float the logs and rafts and keep them from drifting away.

As soon as the water-wheel was done away with at any particular pond there was noticed a deterioration of the Oyster. This I account for in this manner: the use of the water-wheel having been discontinued, it was not necessary to open the gates and refill the ponds twice daily, as was formerly done ; they were only opened occasionally to allow new logs to enter the ponds, and often several days would elapse before the water was changed, this we can readily see was injurious, as we know that on some days the evaporation from these ponds is over two inches, and this continuing for several days would make the water very salt. Then again, hard rains have been known to freshen them considerably. But as they appeared to be just as prolific the matter was not remedied.

The owners of some of these ponds, thinking to improve the Oysters and at the same time cultivate them to advantage, removed all the logs from the ponds ; before the second season was over they noticed that the beds were somewhat depleted, but as there had been heavy draughts upon them, thought to restock them, which had not been necessary before, so without any experience or experiment, they placed in the ponds hundreds of bushels of seedling oysters from the bays and creeks of the river.

To their utter amazement and great financial loss all of these oysters died, but few survived the first year, and they never produced any young. Thinking that the cause of the trouble was in the water, they flushed their ponds daily, the old Oysters were perceptibly improved but all the transplanted ones died, and no young were produced, thus the beds were almost completely exhausted, the owners became disheartened, and many of the ponds were abandoned. In 1868 and 1869 a company was formed which secured the finest and largest of the ponds, and, with the outlay of an enormous sum of money, they were stocked with several varieties of oysters. It had the most experienced oystermen to plant the seedlings, and some of the best scientific minds were interested in the venture, among them, our cultured brother member, the late John McCrady, who had made the Oyster and its diseases a special study.

The Company met with utter failure, either to cultivate or reproduce the oyster, in the second year the venture was abandoned, and the reproduction of the Mill Pond Oyster has since only been attempted on a small scale, and with but partial success. For the last ten years it has been obsolete. I do not know if any scientific mind has looked into this mystery, or tried to solve the reason of the failure, but I have made some attempt to discover it, and I believe I have been successful. My first investigation was to ascertain why the transplanted oyster would not live. It has been held that the Oysters of the ponds were diseased or infested by some parasite which killed the seedlings. This, I believe, was Mr. McCrady's opinion also, but I found that the death of the seed oyster was caused simply by its being smothered, it did not have the gills to breathe or the power to free itself of the mud, and consequently died from want of oxygen and food.

I should mention here that these ponds have mud bottoms, very soft, a perfect ooze in fact, which contains a low organic plant somewhat like a sea weed whose fibres pass through it in a perfect network, like a connective tissue, to a depth of several feet. This fibre supports the oyster, but not entirely, as I will show below.

It is impossible for a bay oyster to live in this mud, its own weight will carry it below its surface, it cannot then obtain oxygen or food and dies. Being satisfied on this point, the question arose in my mind: why was not the native Pond Oyster smothered also? and it was only by close study of its habits, and comparison of its anatomy, that I have been able to understand its peculiar life.

Looking at the beds of these Pond Oysters, one would scarcely have thought, unless familiar with its habits, that they contained oysters. The oyster gatherers knew where to look for them by a small hole or depression of the surface of the mud. At the centre of this depression, just under the surface, the Oyster was found, invariably in a perpendicular position, and partially covered by a frill of green sea-weed, which always grew over and completely covered all of the shell which was not encased in the mud.

Believing that the Pond Oysters had some power of preventing the mud from closing over them, I filled several of these depressions with an inch or two of mud, just above the oyster, which was about a foot below the surface. Very soon after I noticed a jet of water burst through the mud with force enough to scatter it; this performance was repeated several times in quick succession and continued every few minutes until the oyster had completely cleared away the mud above it. Each oyster which I covered did this in the same manner, apparently by opening the shell and closing it suddenly. I took a bay oyster and a pond oyster, and placed them side by side in the mud, about two inches below the surface, and on visiting them the next day I found that the pond oyster had cleared itself of the mud above, but the bay or river oyster was still covered. Thinking that perhaps if placed in the mud with a little assistance, it might soon learn this art of clearing itself, I placed a bay oyster between two pond oysters which, in clearing themselves, would keep it clear also. A month later I took it out and it was dead, with every appearance of having been smothered. This leads me to believe that the bay oyster not only lacks the power of clearing itself of the mud, but is also unable to reach the oxygen in the mud, *for if kept above the mud it fattens and grows excellently.* With the knowledge gained in these experiments, I have since been able to work out the cause of the disappearance of this excellent bivalve from our ponds, and also to note some of its unusual developments.

The spawning season of the oyster in this latitude, is usually, with slight variations according to conditions, from the middle of March to the middle of August. During this time the ova are found floating about in the bays and rivers. They float until they reach a certain stage of development and then sink to the bottom. The ova of the pond oyster are usually confined to the ponds, but although its parents live in the mud, if the egg falls to the bottom it dies; it never develops *in* the mud or *on* the mud. As the microscope shows no difference between this ovum and that of other oysters, I was puzzled for some time to learn how this oyster ever developed and reproduced. I believe I have solved this problem, and, in doing so, ascertained the cause of the exhaustion of these beds.

I have mentioned the fact that these oysters were at their best during the time that the ponds were used as log ponds, and that soon after the removal of the logs the oyster began to disappear. The pond owners could see no relation between the oyster and the logs, but such a relation did exist. As the egg was killed by falling in the mud, it must have something to keep it above the mud until it could develop to withstand it, this office the logs performed for it. As the egg floated about it became attached to one of these floating logs, and if the log remained many months in the pond every part of its surface under the water was covered with young oysters, and as this increased its gravity, it soon sunk to the bottom. All the oysters on the under side were killed, but those above the mud developed rapidly. At the end of the second year they were quite large enough for transplanting, but in the Pond Oyster this was never done; in the bay oyster it is at the present time the usual custom in the business of cultivating the oyster; the Pond Oyster was always left entirely alone, until it was "picked," as the gathering of them was called.

At this stage of the second year I gathered a few from a log and placed them on the mud with great care, and in about two months two-thirds of them were dead. It was evident that the mud had killed them, so I studied the logs bearing oysters in the pond closely to find the reason. Very soon after a log enters one of these ponds the *Teredo* attacks it, and, if lying on the mud, in about three years entirely destroys it, this gives the oyster time to develop gradually to the conditions of its surroundings, for the log is, during this time, slowly settling in the mud, where, at the end of the third year, it begins to fall to pieces, and the oysters clinging to it are gradually lowered in the mud, and as small deposits of mud fall on them at each tide, they, of necessity, learn to clear themselves of it. In the course of time the log completely disappears and the oyster is left to itself; if any hard substance comes in contact with it, it soon attaches itself to it apparently in an effort to keep above the mud. The work of clearing itself of the mud causes an unusual development of the muscle that closes the shell; in the Pond Oyster it is at least one-third larger than in the bay oyster.

It will thus be seen why the logs are essential to the life of this oyster. The few that are now to be found are about the remains of some old log that has drifted into the pond and been destroyed by the teredo.

An experiment was made some time ago, of placing stakes upright in the mud standing about two feet above it, so as to catch the eggs as they float about, as is done in Europe where oyster culture is a science; this experiment promised success the first year, but the teredo was so active that it cut off the stakes at the surface of the mud and destroyed them so rapidly that the oysters were thrown into the mud too suddenly and only a few survived. If we compare a pond oyster, out of the shell, with a bay oyster, we observe not only the toughness and large size of the muscle in the former, but a great development of the mantle or gills, which, I believe, is caused by the necessity for having a larger and more perfect breathing apparatus to reach the oxygen in its muddy bed.

In the few clams which are found in these ponds, I note also the excessive development of the adductor muscle, which renders them inedible, for almost all of the animal is muscle. They can live farther down in the mud than the oyster, and it may be of interest to know that they keep up a constant circulation of water in and out of their holes by the use of this jet. I have found the clam from a foot to two feet under the mud; the oyster succumbs on sinking more than 8 to 12 inches.

APRIL 26TH, 1888.

Vice-President H. P. ARCHER in the Chair.

Books Received.

Royal Society, London: Proceedings, No. 263.

Elisha Mitchell Scientific Society, Chapel Hill, N. C.: Journal, 1887, Part 2.

Journal of Comparative Medicine and Surgery, Philadelphia: Vol. IX, No. 2.

Museum of Comparative Zoology, Cambridge: Bulletin, Vol. XIII, No. 8, and Vol. XIV, No. 1.

California Academy of Sciences: Bulletin, Vol. 2, No. 8.

American Philosophical Society, Philadelphia: Report on Scientific Value of Volapük.

A communication from the American Philosophical Society of Philadelphia, concerning the scientific value of *Volapük*, was read and referred to Prof. Henry E. Shepherd.

Mr. Mazÿck read the following notes which had been prepared by Mr. E. A. Smyth, Jr., in reply to the letter from Mr. Alexander which was read at the last meeting:

I. The larger forms of *Mantidæ* found in Africa, South America, and other tropical countries occasionally feed upon small birds. Such cases have been reported by many travellers and naturalists. But these species are some four or five inches in length, and with seizing limbs powerful in proportion, so that they exceed greatly in size and strength our Carolina Mantis. The incident mentioned by Mr. Alexander is probably the first recorded where our mantis has attempted to capture a bird.

II. The Humming Bird, in its native state, is popularly supposed to live entirely upon the nectar of flowers. That this is not wholly true has been shown by many observers and writers. Examining the structure of the tongue of the Humming Bird, we find that, although it is tubular, and evidently intended for suction, it is also barbed, in the manner of the tongues of birds which "use that member for darting suddenly out and catching up small objects", and this shows an adaptation for insect food. In support of which we find that Audubon asserts that Humming Birds eat minute insects; Darwin, upon the dissection of many species from different quarters, found fragments of the wings of minute flies, evidently gnats, in the stomachs of his specimens; Wilson says "I have seen the Humming Bird, (*T. colubris,*) for fully half an hour at a time, darting at those little groups of insects that dance in the air in a fine summer evening: retiring to an adjourning twig to rest, and renewing the attack with a dexterity that sets all other fly-catchers at defiance"; and Bullock relates that in Mexico, he has seen Humming Birds steal the half dead flies caught in the webs of large spiders, and that too, at some evident risk to themselves. Charles W. Webber tells of several Humming Birds that he kept in captivity, that their food was ordinarily an artificial syrup of sugar or honey and water, which they sipped from a cup or from the corollas of flowers, where it was placed for them, and which they seemed to prefer to the natural nectar of flowers: but that after a time they would regularly seem drooping, and when given their liberty, immediately proceed to hunt and devour with avidity small garden spiders, which they would pick from the webs, while on the wing, so delicately as not to shake the web. Those who have kept Humming Birds in captivity have fed them principally upon sugar or honey and water, and also, as Azara and Wilson state, upon small insects attracted by and drowned in the syrup. Humming Birds are readily tamed and become easily reconciled to captivity. Bullock states that he "had nearly seventy in cages, that no bird was more easily reconciled to its new situation, and that by attention they might easily have been brought to Europe". Charles Peale, of Philadelphia, reared two from the nest, which were so tame that they readily perched upon the shoulders of Mrs. Peale.

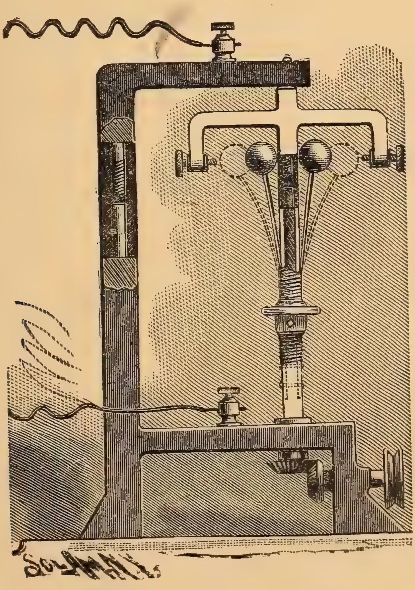
The following paper was read:

AN ELECTRICAL SPEED INDICATOR.

BY F. W. SCHLEPEGRELL, A. M.

In wood-working and other high speed machinery, it is of vital importance that the number of revolutions per minute should be kept at the rate for which the machine was built. When saws and planer knives are running at their normal speed, the cutting surface acts like a chisel, cutting its way through the wood. When, however, it is below that rate, the cutting surface no longer makes a clear smooth cut, but drags and tears its way through the wood, not only doing less work, but doing it in an inferior manner. On the other hand, when machinery is run above its normal speed, it is compelled to do work beyond its capacity, and breaks down in its weakest parts, besides endangering boxes and journals from over heating. The diminution of the speed may be caused by the fall of the steam-pressure in the boiler, slipping of belts, &c., while the irregular working of the governor, or the breaking or slipping of the governor belt is the principle cause of an increase of the speed.

A simple device by which the increase or diminution of speed in machinery, above or below its normal rate, may be indicated electrically, is here illustrated.



ELECTRICAL SPEED INDICATOR.

The indicator shaft, arranged to receive motion conveniently from the machine whose speed is to be indicated, is formed of two parts connected together by an insulating sleeve, and is journaled in a frame whose upper and lower parts are also connected by a threaded insulating sleeve, binding posts, connected with an electric bell or alarm, being secured to the lower and upper parts of the frame. In grooves on opposite sides of the indicator shaft are secured flat springs, with a weight, preferably of spherical form, on the outer extremity of each spring, a nut being fitted to move up or down on the shaft to vary the length of the free ends of the spring arms. The weights are adjusted relative to the motion of the indicator shaft when driven by a machine, so that when the machine runs at its normal speed the weights will revolve in a position between the upper part of the shaft and the contact screws on either side, the variation in the throw of the spring arms being indicated by the dotted lines. When the speed of the machine increases so that the weights touch the contact screws, the circuit is completed and an alarm is given, a like effect being also produced when the machine runs slower than its normal speed, or when it stops, as the weights are then brought into contact with the upper part of the indicator shaft, thus completing the circuit. The indicator may be adjusted to adapt it to higher or lower speeds by turning the nut on the lower portion of the indicator shaft, thus shortening or lengthening the spring arms, and also by turning the contact screws in or out.

This instrument was patented by me June 21st, 1887.

MAY 25TH, 1888.

The President in the Chair.

Books Received.

Museum Francisco-Carolinum, Linz: 46ter Bericht.

Royal Society, London: Proceedings, No. 264.

Norges Væxtrige et Bidrag til Nord-Europas Natur- og Culturhistorie, Christiania:

F. C. Schübeln, Viridarium Norvegicum, Vol. II.

West American Scientist, San Diego, Cal.: Vol. IV, No. 34.

Museo Nacional de México : Anales, Tomo IV, Entr. 2.

Physikalisch-Medicinische Gesellschaft, Würzburg: Sitzungsberichte, 1887.

Museum of Comparative Zoology, Cambridge: Bulletin, Vols. XIV and XV.

Boston Society of Natural History: Memoirs, Vol IV, Nos. 5 and 6.

Dr. Manigault mentioned that a few days ago a live bird had been brought to him by a fisherman for identification, which proved to be a Purple Gallinule, *Ionornis Martinicus*. It was easily held, making no effort to escape, and behaved as though previously domesticated. It had been captured on a fishing boat at anchor off Charleston Bar, having flown there from the adjacent shore. He had known of other instances when the bird adapted itself with but little difficutly to being kept in captivity.

Mr. E. A. Smyth, Jr. remarked that in the Spring and Summer of 1887 Mr. Arthur T. Wayne had found the Purple Gallnule quite abundant near McPhersonville, S. C., in the old rice field "backwaters", which were thickly grown up with reeds. Mr. Wayne found the birds breeding there and secured many specimens of the adult bird and a few of the young and of the egg. The birds were great skulkers and hard to find in the thick swamp of reeds and water, he having to wade up to his waist in order to start them, the reeds being too thick for a boat to penetrate, and it was almost impossible to recover a wounded bird, for which reason he lost a good many that were shot. Mr. Wayne had also noticed that the birds were possessed of spurs or horns, growing from the carpal joint of the wing and extending downwards parallel to and in the same direction as the primary quills. These spurs were from one-half to three-quarters of an inch in length and as sharp as needles, and were evidently used as weapons, both offensive and defensive, as was shown by the manœuvres of the cock birds in the breeding season. The spur was present in both sexes. The same observer has also noticed the presence of a similar growth in the Florida Gallinule (*Gallinula galeata*). Mr. Wayne has been unable to find mention in the works either of Audubon, Coues, Ridgeway, or Baird, of the presence of this spur either in the Purple or Florida Gallinule, and consequently concludes that he is the first to record their occurence. Mr. Smyth also said that the Horned Screamer, (*Palamedia cornuta,*) a bird related more or less to the Gallinules, has very noticeable spurs upon its wings, and is known to use them with considerable effect in combat; these spurs, however, extend in the opposite direction to those of the Purple Gallinule, *i.e.*, towards the front of the bird, and nearly at right angles to the line of the primaries.

Mr. F. W. Schlepegrell made some very interesting statements concerning his observations of the manner of reproduction of the minnow.

As a result of his investigation of the subject, Mr. Schlepegrell was satisfied that the common Fresh Water Minnow, *Leuciscus phixinus*, Cuvier, which is moderately abundant in fresh water ponds and branches in the neighborhood of Charleston, is ovo-viviparous. He was now closely observing this delopment in specimens of the species in an aquarium at his residence and would at some subsequent meeting allude futher to the deeply interesting and important fact.

Dr. Manigault stated that a friend of his, who had kept an aquarium stocked with several varieties of fresh water fishes, had ended by retaining only one, the habits of which he observed for several years. It had not to his knowledge been scientifically described, but could be mentioned as a minnow which inhabits fresh water ponds in the vicinity of Charleston, and is usually seen near the mosses growing in their bottoms. The length of the adult female is one and a quarter inches, the male being half the size. The lateral and vertical measurements of the female at the largest part of the body is one quarter of an inch. The female is of a brownish color, with vertical bars where the mottling is intensified. The dorsal and anal fins have a rounded profile, with a black spot in the centre, and red edges. In the male, only the dorsal fin has these peculiarities.

In an aquarium containing other fishes, the movements of this little one are graceful and fearless. When in danger it darts from side to side with such rapidity that the eye cannot follow it; one was never seen to be captured by other fishes. The period of gestation is 15 days and the number of young usually from three to five. If the parent is not well supplied with food she will devour her young immediately after birth. In a couple of days these acquire sufficient strength to be safe from attack. During the spring months a brood will be born every 15 days.

Mr. Schlepegrell suggested that the fish spoken of by Dr. Manigault was probably not a minnow, but a peculiar, small species of perch.

Mr. Wm. G. Mazyck mentioned that in 1866 Prof. F. S. Holmes, who was at that time Curator of the Museum of the College of Charleston, had shown him alcoholic specimens of fœtal sharks with the umbilical cord and placental attachment intact, as when Prof. Holmes had himself removed them from the body of the parent.

JUNE 28TH, 1888.

Vice-President H. P. ARCHER in the Chair.

Books Received.

Royal Society, London: Proceedings, Nos. 265--7.

Kaiserliche Leopoldina-Carolina Deutschen Akademie der Naturforscher, Halle: Band LII, Nr. 2--3.

American Philosophical Society, Philadelphia: Proceedings, Vol. XXV, No. 127.

West American Scientist, San Diego, Cal.: Vol. IV, Nos. 35 and 36.

J. Leidy, The Fresh Water Rhizopods of North America. *Presented by Dr. C. W. Kollock.*

A letter of resignation from Dr. John L. Dawson, Jr., was read and accepted.

The following paper was read:

Ovo-viviparous Reproduction of the Minnow.

BY F. W. SCHLEPEGRELL, A. M.

SOME years ago, my attention was attracted by finding a large number of small minnows in my aquarium. Having always supposed that the Minnow, (*Leuciscus phixinus* of Cuvier,) was, like other spinous fishes, oviparous, and being certain that no eggs had been laid in the aquarium, I determined to watch the development. Shortly afterwards, I captured from a fresh-water pond, a female minnow with its abdomen very much distended. I placed it in a separate basin of water, and was rewarded, about a week later, by finding that it had deposited its young alive. The young minnows numbered about one hundred, being one-eighth of an inch in length, and were quite active, differing from the mature fish only in their heads, which were larger in proportion. Since then I have frequently observed the ovo-viviparous reproduction of the minnow, the last occasion being about three weeks ago. I have also made careful search in ponds during April, May, and June, when minnows produce their young in this climate, but have never found any traces of eggs, although the young fish could be caught and seen in all stages of growth.

The object of this ovo-viviparous reproduction in the economy of nature, is apparent. The herring and other spinous fishes owe their increase to the enormous number of eggs which they produce, 68,000 having been counted in the roe of a single female herring. This great productiveness alone prevents their extermination, as, it has been computed, not more than one-tenth of one per cent of the eggs escape the dangers to which they are exposed and arrive at the mature state. The minnow, on the other hand, produces but a comparatively limited number of its offspring, 125 being the largest number that I have counted from a single minnow. If these were produced in the egg condition, the species would probably soon become extinct. The ponds where the minnows are found are crowded with carnivorous insects and their still more rapacious larvæ. Frogs and newts abound and, by no means the least consideration, the minnows themselves, which attack and devour everything which they can overcome. Such is the rapacity of the minnow, that, after an aquarium is once established, and the fishes have become accustomed to their new conditions, it is almost impossible to add any more specimens of any kind to the collection. On one occasion, I added to an aquarium which I had kept about six months, two gold fishes about three inches in length. Although the largest minnow in the tank measured scarcely one and one half inches, still at the end of a few hours one of the golden carps was dead and the other, although I took it out and placed it in a separate tank, died soon afterwards. The minnow's method of attack was to seize the gold fish by the tail, fins, or even scales, and worry it to death. A tadpole, which I introduced in like manner, was also soon destroyed, its tail being torn off in bits, although the tadpole was larger than any six of its assailants.

The danger then, to the immature minnow being so great, nature protects it by developing it from the ova before parturition, and it is enabled at once to make efforts to escape from the many dangers which surround it.

I cannot leave this subject without calling attention to the important theory which the ovo-viviparous reproduction of the minnow dispels. The fresh water minnow is found in almost every pond, puddle, or brook which has been in existence any considerable length of time. The accepted theory accounting for this is that the ova of the minnow is dropped in the water by aquatic birds. The ovo-viviparous reproduction of this fish makes this theory impracticable, as the young minnow cannot survive being taken from the water more than a few minutes.

Other theories may account for the minnow being found in some of the ponds. No doubt the overflow of ponds and brooks may carry the fishes to ponds in their neighborhood, but this theory could not account for the minnow being found at Holbrook's place and near the Jewish Cemetery, both of which are 15 miles from any body of water where fresh water fishes are found.

In isolated cases also, fishes bave been known to descend with a heavy shower of rain, having probably been carried upwards by a kind of water-spout ; but this also will account for but very few cases.

In August, 1887, the pond at Holbrook's place had completely disappeared, owing to continued drought. This year, I have examined the water each month and have thus far found no fishes. One of the theories, accounting for the occurrence of fish in ponds that have been dried up, is that the ova is preserved in the moist earth and developed after the water returns. Allowing, for the sake of argument, the possibility of the development of the minnow from ova so deposited, the fish should have reappeared as early as April, but thus far, June 3d, no trace of them can be found.

I shall continue to follow up this subject and will report to the Society any further development which I may observe.

JULY 26TH, 1888.

The President in the Chair.

Books Received.

Museum of Comparative Zoology, Cambridge: Memoirs, Vol. XIII, No. 9.

Journal of Comparative Medicine and Surgery, Philadelphia: Vol. IX, No. 3.

Smithsonian Institution: Report, 1885, Part 2.

Verein für Naturkunde, Offenbach: Berichte 26--28.

Hydrographic Bureau, Washington, D. C.: Storm and Weather Charts. *From Vice-President H. P. Archer.*

Member Elected.

THOMAS ROYLE, Esq.

Published Mch., 1889.

AUGUST 23D, 1888.

Dr. G. E. MANIGAULT in the Chair.

Books Received.

The Corresponding Secretary reported the receipt of a large number of Government Reports, &c., *through Hon. M. C. Butler, M. C.*

Dr. Manigault exhibited a specimen of the Cutlass Fish, *Trichiurus lepturus,* from the coast of South Carolina.

Mr. Mazÿck exhibited specimens of *Helix Bermudensis,* PFEIFFER, and of typical species of the various genera and sub-genera to which it has been referred, and read the following

Note on Helix Bermudensis, Pfeiffer.

BY WM. G. MAZŸCK.

IN the Proceedings of the Zoological Society of London for 1845, Dr. Pfeiffer described this well known shell under the above name. For many years it has occupied a very uncertain position.

In 1854, H. and A. Adams, in their Genera of Recent Shells, Vol. ii, p, 115, placed it in *Trochomorpha,* ALBERS, a sub-genus of *Zonites,* MONTFORT, in the sub-family *Hellicellinæ,* Family *Oleacinidæ* of their classification.

Von Martens in 1861, Albers' Heliceen, p. 156, has it in *Carocolus,* MONTFORT, a sub-genus of the great Linnean *Helix.*

Mr. Thomas Bland, in the same year, in his Catalogue of the Land Shells of the West Indies, Annals of the Lyceum of Natural History, New York, Vol. vii, mentions it simply as *Helix Bermudensis,* PFR., but in 1872, in a joint paper with Mr. W. G. Binney on the Lingual Dentition of several species of Terrestrial Pulmonata, Ann. Lyc. N. Y., Vol. x, p. 221, he suggests its removal to "the *Vitrinea* of von Marten's arrangement", without, however, designating its generic position.

In October, 1874, Mr. Bland mentions the species, Ann. Lyc. N. Y., xi, p. 77, as *Hyalina Bermudensis,* PFR.

In September, 1876, Mr. Binney, Proc. Acad. Nat. Sci. Phila., p. 184, gives the details of the anatomy of the species and says : "The absence of the caudal mucous pore removes the species from *Zonites,* nor can it be placed in any recognized genus."

In 1878, Clessin, in Pfeiffer's Nomenc. Helic. viv., p. 69, has it under *Hyalinia*, Ferussac, in the sub-genus *Polita*, Held, (with *H. cellaria*, Muller, as the type of the sub-genus,) separating it, with *Zonites Isserica*, Letourn. and *Helix labilis*, Gould, from the other species of his list by an asterisk, thus indicating his doubt of its being correctly placed there, and citing *Zonites Bermudensis*, Bland, as a synonym.

Mr. Binney having clearly shown its lack of affinity with *Zonites*, of which many systematists regard *Hyalina* as a sub-genus, and he, with Mr. Bland, having proven the necessity of its removal from the *Helicacea*, I, seeking to define its position more closely, propose that the species shall be considered the type of a new genus of the Family *Vitrinea* of Clessin's Pfeiffer's classification, (< *Vitrinea*, Von Martens' Albers,) to be called *Juno* and thus characterized :

JUNO, Mazÿck.

Testa umbilicata, conoideo-depressa ; superne striata, apice obtusa ; anfractus 7–8 planulati, ultimus acute carinatus ; basi subconvexus, lævis ; apertura obliqua, subrhombea ; peristoma simplex, acutum, marginibus callo tenui junctis ; margine collumellari breviter reflexo.

Maxilla tenuissima, arcuata, medio tuberculo obtuso munita.

Radula elongata, angusta. Dentes centrales tricuspidati ; dentes laterales bicuspidati ; dentes marginales aculeati, in lineis obliquis dispositi.

Discus gressorius distinctus ; glandula muscosa nulla ; apertura genitalis sub margine pallii, nec ad basin tentaculi oculigeri dextri posita.

Typus *Helix Bermudensis*, Pfeiffer.

Mr. Mazyck also mentioned that he had recently found *Stenogyra subula*, Pfr., in great numbers under a few planks laid in front of the main door of Bennett's Rice Mill on East Bay Street in this City, where it had been first observed by Mr. C. S. Bennett who had directed his attention to it. The locality is extremely restricted, being confined absolutely to the space — about eight by eighteen feet — covered by the planks, between the crevices and on the surface of which, after a shower of rain, it appears in enormous abundance. It doubtless feeds upon the sweepings of the mill. It is a West Indian species and has been noticed at no other point in the United States except Mobile, Alabama.

Dr. G. E. Manigault, speaking of the Cutlass Fish exhibited by him, said that it had been sent to him for identification by Dr. R. A. Kinloch by whom it had been captured off Sullivan's Island. It is also known as the Silver Eel, and in Europe an allied species is called the Scabbard Fish.

It abounds in the tropical Atlantic and is found in large quanties off the coast of Florida and in the Gulf of Mexico. The St. John's River and Indian River are its favorite haunts in Florida.

The specimen is about eighteen inches long and is not adult, as the length of four and five feet is commonly reached.

There are instances of its wandering off from its regular habitat at considerable distances during the summer months, individuals having been captured off Wood's Hole on the coast of Massachusetts. This is believed to be the first recorded instance of its capture off the South Carolina coast.

It is an excellent table fish and is assiduously fished for along the coast of the Island of Jamaica where it is much esteemed.

Mr. E. A. Smyth remarked that on the 4th of August, he was collecting birds on the various islands that surround Stono Inlet, While walking on the front beach of the western end of Folly Island, he picked up a dead bird that had evidently been washed ashore. The skin and flesh had been eaten away from the head and neck, but without destroying the beak or the bones of the skull. The rest of the bird was in fairly good condition, although not suggestive of "Araby the blest." Mr. Smyth stated that he recognized the bird as the remains of a Dusky or Audubon's Petrel. Knowing the rarity of the bird in this quarter, he determined to attempt the preservation of the specimen and started back to his boat for that purpose. Upon getting into his skiff to row to his yacht which was anchored some distance off the beach, he observed what appeared to be a wounded bird in mid-stream, coming in apparently with the wind and tide. Having been shooting at Long-billed Curlews the greater part of the day, as they flew to and from Bird Key, he naturally supposed this to be one of the wounded that had fallen into the water. He rowed towards it with the intention of picking it up, but before getting within gunshot range, the bird rose and flew seaward, with that peculiar curvature of wing distinctive of the Puffins and Petrels. The squally appearance of the weather forbade a trip seaward in an open boat, so restraining his desire to obtain the bird, he turned and rowed back to the yacht. Scarcely five minutes had passed, when, happening to look seaward, he saw the same bird drifting down upon the boat as before. The bird continued its drift until almost on the boat when he shot it. Upon picking the bird out of the water it was found to be, like the first, a Dusky Puffin, (*Puffinus Auduboni*,) only in perfect condition. Mr. Smyth stated that it was the thinnest specimen of a sea bird that he had ever handled, the skin being entirely free from the masses of fat usually found in Ducks and Gulls. It is now in his collection.

This capture is worthy of record, being only the second authentic instance, in his knowledge, of the capture of this bird around Charleston; the other specimen was taken on Sullivan's Island, and is now in the collection of Mr. Arthur T. Wayne of Charleston.

A letter of resignation from Gen. E. McCrady was read and accepted.

SEPTEMBER 27TH, 1888.

The President in the Chair.

Books Received.

History and Work of the Warner University, Rochester, N. Y.: Vol. I.

Royal Society, London: Proceedings, No. 270.

Société Linnéenne du Nord de la France, Amiens: Bulletin Mensuel, Vol. VIII, Nos. 175--186.

Connecticut Academy of Arts and Sciences, Vol. VII, Pt. 2.

Mr. Thomas Royle exhibited an undetermined fossil from the phosphate mines on Filbean's Creek, S. C.

35TH ANNIVERSARY MEETING.

DECEMBER 20TH, 1888.

The President in the Chair.

Books Received.

West American Scientist, San Diego, Cal.: Vol. V, Nos. 1 and 2.

Kaiserliche Akademie der Wissenschaften, Wien: Sitzungsberichte, 1887, I Ab., Heft 1--3, 5, 6 and 10; II Ab., Heft 3--10; and III Ab., Heft 1--10.

Journal of Comparative Medicine and Surgery, Philadelphia: Vol. IX, No. 4.

Royal Dublin Society: Transactions, Series II, Vols. III and IV; Vol. V, parts 7 and 8; and Vol. VI parts 1 and 2.

Royal Society, London: Proceedings, No. 271.

Museum of Comparative Zoology, Cambridge: Bulletin, Vol. XVI, No. 2 and Vol. XVII, No. 2.

Museo Nacional, San Jose, Costa Rica: Anales, pt. 2.

Mr Mazÿck exhibited specimens of *Belemnites*, *Belemnitella*, and the pen of *Loligo*, and suggested that the fossil exhibited by Mr. Royle at the September meeting is a portion of the phragmocone of a gigantic cephalopod allied to *Belemnites*.

Dr. Manigault exhibited two groups of unusually large Balani from a vessel recently arrived from Africa.

Prof. H. E. Shepherd submitted the following

REPORT:

In response to the communication of the American Philosophical Society regarding the propriety and feasibility of establishing "a language for learned and commercial purposes," I beg leave to present to your consideration the following Report:

The plan suggested seems to me not only possible of accomplishment, but in every respect desirable for the promotion of the ends indicated, learning and commerce.

It is unfair and unjust to measure the possibilities of the present scheme by such plans or endeavors as have been projected in former ages, such, for example as the system of Bishop Wilkins for establishing a universal language. The conditions under which the present scheme is proposed are essentially different from those that existed before the rise of internationalism in its varied and constantly increasing forms, and before the wonderful development of modern comparative philology. All the influences of our complex civilization tend more and more to unity of idea and action, modern scientific progress and linguistic investigation have in large measure overcome the barriers and the prejudices of race and speech, and philology, since the age of F. Schlegel and William Von Humboldt, by demonstrating the original unity of the Indo-European or Aryan family, has immensely diminished the difficulties that a century ago rendered the success of any such movement as that now under consideration, apparently insuperable.

The several branches of the Indo-European family are becoming more and more familiarized with one another's idioms ; to illustrate : fifty years ago the language of Schiller and Goethe was almost unknown in England and America and totally without recognition in the most advanced institutions of learning. Now all this is changed, and in addition, the comparative study of the Indo-European group is steadily bringing its branches into more intimate and harmonious relation. The conditions of our modern civilization seem to render the present epoch an auspicious one for the inception and successful consummation of the plan. The nature of the proposed universal medium can be determined only by a conference of scholars representing the several branches of our linguistic family. As in all great achievements, compromise and conciliation will be requisite, forbearance and concession, inevitable. It seems at least certain that peculiar difficulties inherent in every tongue and constituting its *shibboleth*, should be omitted in the formation and development of a universal medium. Points of agreement or resemblance should be retained so far as possible ; strongly marked differences and distinctive difficulties excluded.

It might be given as a possible reply to the argument in behalf of a universal medium, that the aggressive, assimilative genius of the English race, will in due course of time, render their tongue the prevailing speech of commerce at least. The *unphonetic* character of our speech will always prove an obstacle to its adoption as a universal medium, even for a specific purpose, nor can we expect that the other branches of our linguistic family would concede to it a monopoly or an exclusive preëminence even in this regard. In the judgment of your Philological Curator the scheme suggested is possible of accomplishment, and if judiciously and skilfully developed, may be productive of beneficent results in advancing the ends of commercial enterprise, together with all the incidental and essential consequences in the promotion of Christian civilization that follow from such advancement.

Dr. G. E. Manigault stated that the groups of *Balani* exhibited by him were removed from beneath the rudder or the bark Sea Gull recently arrived in distress form the coast of Africa. The largest of these measures almost three inches in length, and their growth must have occupied a considerable time. In two of the empty cavities were small fishes, (one in each) which were there either for safety or convenience and had been there for some time, as they were not of a species common to the waters of the harbor of Charleston. The specimens were presented to the Museum of the College of Charleston by Dr. John C. Faber.

Mr. Schlepegrell spoke briefly of the circulation of the blood in the common tadpole, beautifully illustrating his remarks with the aid of the microscope.

The following Officers were elected :

President,
LEWIS R. GIBBES.

Vice-Presidents,
J. P. CHAZAL, H. P. ARCHER.

Corresponding Secretary,
F. W. SCHLEPEGRELL.

Recording Secretary and Treasurer,
WM. G. MAZŸCK.

Librarian,
G. E. MANIGAULT.

Curators,

F. W. SCHLEPEGRELL,
G. E. MANIGAULT,
C. U. SHEPARD,
J. GUITÉRAS,
C. B. COLSON.
WM. G. MAZYCK,
E. A. SMYTH, JR.
T. ROYLE,
J. K. BLACKMAN,

A letter of resignation from Prof. H. E. Shepherd was read and accepted.

JANUARY 24TH, 1889.

Dr. G. E. MANIGAULT in the Chair.

The Chairman exhibited a fine specimen of the fruit of *Martynia proboscidea*, Elliott, from McPhersonville, S. C.

FEBRUARY 28TH, 1889.

Vice-President H. P. Archer in the Chair.

The following paper was read:

Notes on Butterflies found in the vicinity of Charleston, S. C.

BY ELLISON A. SMYTH, JR.

The following List is not by any means claimed to be complete, but is the result, only, of the personal observations of the writer. Therefore there may be statements which are contrary to the experience of others, and also omissions, which a closer search would supply. The writer would suggest that he knows his opportunities for observation have been limited, but he feels that the experience of many limited observers, when combined, gives a knowledge of any subject, perhaps not to be otherwise obtained. With which humble apology for his intrusion upon the time of the Society, he presents the following compilation of his notes, with the hope that it may not be devoid of interest.

By the vicinity of Charleston, is meant the country within a radius of fifty miles, though as a rule the City and its immediate environs are meant.

The Genus *Papilio* proper, from the large size and frequent brilliant coloring of its species, has long held the post of honor at the head of the list of Lepidopterous insects. There seems reason now to believe it less highly organized than some of its more humble relatives among the *Nymphalidæ* and *Danaidæ*, and it has been by most modern writers deposed from the throne and placed very low in the ranks, in this List, however, the old style of classification will be preserved.

Published June, 1889.

Papilio philenor, *Linn.*

Clad in dark, but rich velvet tints, this fly may be well considered the handsomest of his tribe in our limits. I well remember the capture of my first *philenor.* I was a very young collector, with a knowledge of the genus *Papilio* confined to one battered specimen of *Papilio cresphontes,* though even unaware of its name, and when this new and unknown beauty was taken out of my net, I felt amazed to find that there were actually two swallow-tailed butterflies found near Charleston. Directed by a friend to the works of Abbott and Smith in the Charleston Library, I there found that there were many more butterflies in my neighborhood than I had dreamed of ; a fact at which I soon ceased to be astonished.

Philenor is not as common in the vicinity of Charleston as it is in the Counties of the Middle and Up Country. There is a noticeable difference in size and beauty of color in the specimens found in the mountainous portions of the State, and those found on the Coast, the latter being, as a rule, smaller and duller colored. In Clarendon County the majority of specimens taken are unusually small, and this has been my experience for two or three seasons. It is probable that the food plant, *Aristolochia,* may be scarcer and of inferior quality on and near the Coast. If this be so, it would account for the difference in quantity and quality of the fly. I have taken *philenor* feeding upon the freshly dropped dung of cattle, and it is often and easily taken at the margins of streams where they are crossed by roads, a thistle patch, however, is one of the choicest feeding grounds, not only of this but of many other species, notably *Papilio troilus, Argynis Diana,* and the *Pyrameidæ.*

Philenor is seen occasionally in the City of Charleston, though it cannot be considered as a species often there met with. It is, of course, more frequent in the country around than in the City itself.

Papilio (*var.*) Marcellus, *Bdl.*

Papilio Ajax, L., the Spring form, I have never yet taken, and I have never seen *Marcellus* in the immediate vicinity of Charleston ; in Clarendon County I have taken it in August. I consider it unusual near the Coast. In the Counties of Anderson and Greenville it is one of the characteristic *Papilios,* and I have found it breeding there on the Pawpaw (*Anona*).

Marcellus is most generally seen flying rapidly through the open forests, its long tails streaming and flickering in the wind. When flying it seems much larger than it really is, owing to the striking appearance presented by its many stripes and sharp contrasts of color. I have occasionally seen it hovering around and alighting upon sun-flowers, and it has the same fondness possessed by *troilus* and *philenor* for the wet, sandy edges of brooks. A shady, sandy road crossed by a stream, is pretty sure to have a specimen of *Marcellus* drinking up the moisture at the water's edge, while hosts of little blue *Lycaenas,* and representatives from the yellow tribes of *Terias* and *Callidryas* relieve the sombre appearance caused by the dark and stately *Papilios,* and rise in bewildering clouds of color as the vehicle splashes through the water. I have, however, chiefly seen *Marcellus* flying rapidly, with quick, incessant strokes through the woods, and at such times a sharp run and a quick, sure stroke are required to secure the specimen.

Papilio cresphontes, *Cramer*.

Owing to the number of orange trees that grow in and around Charleston, *cresphontes* constitutes a conspicuous element in the butterfly fauna of this region. In the City I have found it decidedly the most common of the *Papilios*, more so even than *asterias*. There is something very tropical looking in the appearance of this large butterfly, with its broad spatulate tails and handsome contrasts of color, as it floats with lazy flappings through the gardens, and the presence here and there of a cluster of banana trees adds to the impression. In the early part of April *cresphontes* is generally on the wing, and as early as May its large yellow eggs can be found on the tender young leaves and new stems of the orange trees. The larvæ bear a decided resemblance to the excrement of fowls, and though this resemblance is doubtless protective, they are readily eaten by birds. *Cresphontes* has a habit, especially in wet weather, of resting upon the leaves of the orange trees, or other trees and shrubs, protected by the overhanging foliage, and when so at rest its wings are not elevated, but are depressed at a reentrant angle. I once saw, during a Summer thunder shower, about a dozen individuals of this butterfly, some at rest, and others slowly flying to and fro under the protecting screen of a mass of *Wistaria* that offered a complete shelter from the storm. The larvæ, as is usual with all the large handsome larvæ of lepidopterous insects, are considered by the vulgar as intensely poisonous and most deadly to life. Of course they are absolutely harmless, though when touched, like the larvæ of all *Papilionæ*, they emit a pungent odor.

Papilio turnus, *Linn*.

I have only twice seen this species in the City of Charleston, though it is quite common in Clarendon County, where it may be readily caught at pools of water and moist places in the roads. The males I have found more frequently than the females, and larger and more richly colored than northern examples. The prevailing female type is the black form, (*Papilio glaucus*,) and this is sometimes caught of an extraordinarily large size. I have in my collection a fine example of the normal yellow female form, caught in Clarendon County, S. C., and this is the only one of the kind that I have ever seen in the South, though it is the usual form met with at the North, where *glaucus* is rarely, if ever, taken.

Papilio asterias, *Fab*.

This is one of the commonest of our *Papilios*, and its large, handsome green larvæ may be found in fennel patches at the proper season. I have found them most common on the sweet fennel, and as early as the middle of April. I have had a curious experience with this fly, which I think worthy of mention: In May, 1879, I noticed a female laying eggs in a fennel patch, and following her, gathered quite a number of eggs, which in due time became pupæ: the greater number entered the imago state on the 26th day of May, 1879, having been eleven days in the pupa state; but four of the pupæ remained all through that Summer, the following Autumn and Winter, and in the latter part May, 1880, came forth as perfect imagos, and normal in every respect, having remained about a year in the chrysalis state. I bred no more of this fly in quantities until the Spring of 1888, when I obtained a number of the larvæ, they all went into the pupa state, and in the proper course of time most of them came forth as imagos, but seven of their number are still in my breeding cage, apparently healthy pupæ, and I have no doubt that this Spring they will become butterflies.*

This seems, without a doubt, a provision of Nature, that should all of the imagos of one brood be destroyed in a season, there would be left some to propagate the species the ensuing season. The questions that this offers for consideration are, has a like occurrence ever been noticed with any other butterfly? and if not, is *asterias* subject to any dangers in the imago state from which other flies are exempt?

Papilio troilus, *Linn.*

I can lay no claim to this species as a citizen, though it is common enough in the country around, and I have found its larvæ upon sassafras bushes in the Magnolia Cemetery in May, and seen the fly in the same place. The larvæ of this species and that of *P. palamedes* bear a strong resemblance to each other. In some examples of the male fly from Asheville, N. C., in my collection, the tails of the posterior wings contain two green parallel lines. Such examples seem more highly colored, also, than the ordinary run. I have never observed this in Northern examples and believe it to be peculiar to Southern forms.

Papilio palamedes, *Drury.*

Every season a few of this species may be found in the City. I have seen them on our coast islands quite commonly, and think that there the larvæ may feed upon the myrtle. In Clarendon County, where *palamedes* is rather common, it may be seen flying through the forests or hovering around moist places in roads. The flight is very similar to that of *cresphontes*, though not quite so floating, and is seldom elevated more than four or five feet from the ground when in the woods. It is not as easy to capture when on the wing as appearances would make one believe. When drinking at pools it is more readily taken. I have found the larvæ on a species of swamp bay with dark, narrow leaves, (not *M. glauca*,) and have seen the females hovering about the same tree.

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* Since writing the above, one of these pupæ has, on the 3d of April, 1889, discharged its occupant, a female very handsomely colored, though much below the average in size.

Pieris monuste, *Linn.*

My experience with this fly is confined to one season. In April, 1876, they were, for about a week, exceedingly abundant in my garden, every flower being crowded with them. Since then I have never seen the fly alive. All that were observed at that time were of the smoky variety. *Monuste* was formerly reported as abundant around Magnolia Cemetery.

Pieris rapæ, *Linn.*

With a specimen of this butterfly my collection was commenced. I remember the eagerness with which, as an embryonic collector, I had awaited the coming of Spring. Through the Winter I had made what seemed to me most extensive preparations for starting business as a Lepidopterist. In the course of a ramble through the kitchen garden, which for a long time constituted my hunting ground, I had been made happy by the discovery, in an angle of the wall, of a chrysalis, the first I had ever seen. After a grave consultation with my books on Entomology, consisting of Duncan's volumes on that science, contained in the "Naturalist's Library," the determination was reached that it must be the pupa of the "Cabbage Butterfly," and I can still feel the sense of desolation and despair that came and dwelt with me when the chrysalis finally succumbed to my too assiduous attentions. (It had roasted before the fire where it had been placed in the vain hope that the warmth would prematurely dislodge the occupant.) And the memory of the Spring morning when the first butterfly of the season was seen fluttering among the cabbages in the garden, and of the thrill of delight which followed its capture, causes *Pieris rapæ* to have a warm place in my regard.

With the exception of *Pieris monuste*, as before noted, this is the only representative of its family that I have ever seen around Charleston. *Pieris protodice*, BDL., LEC., is by some authors called the Southern Cabbage Butterfly, with the exception, however, of one specimen seen in Birmingham, Ala., in Oct., 1887, I have never seen it in the South, though I used to get it commonly around Princeton, N. J., of course I speak only of my own personal observation.

MARCH 28TH, 1889.

Vice-President H. P. ARCHER in the Chair.

Books Received.

Essex Institute, Salem, Mass.: Bulletin, Vol. XX, Nos. 1–3.

Koninklijke Zoologisch Genootschap Natura Artis Magistra, Amsterdam : Bidragen tot de Dierkunde, Feest Nummer, 1888.

Elisha Mitchell Scientific Society, Chapel Hill, N. C. : Journal, Vol. V, part 2.

Museum of Comparative Zoology, Cambridge : Bulletin, Vol. XVI, No. 3 ; Vol. XVII, No. 3 ; and Reports, 1887--8.

Journal of Comparative Medicine and Surgery, Philadelphia : Vol. X, No. 1.

Royal Society, London : Proceedings, No. 272--6.

Académie des Sciences, Arts et Belles-Lettres de Dijon : Mémoirs, Tome VIII.

American Philosophical Society, Philadelphia : Proceedings, No. 128 ;

Supplementary Report of the Committee on an International Language ;

Rules and Regulations of the Henry M. Phillip's Prize Essay Fund ; and

Rules and Regulations of the Magellanic Premium.

Smithsonian Institution : Report on International Exchanges, 1888.

Academy of Science, St. Louis : Transactions, Vol. V, Nos. 1 and 2.

Boston Society of Natural History : Proceedings, Vol. XXIII, Nos. 3 and 4.

Dr. G. E. Manigault exhibited several rare bird skins, chiefly North American.

MAY 23D, 1889.

Vice-President H. P. ARCHER in the Chair.

Books Received.

Journal of Comparative Medicine and Surgery: Vol.X, No. 2.

West American Scientist, San Diego, Cal.: Nos. 34 and 42.

Royal Society, London: Proceedings, No. 277.

Essex Institute, Salem: Bulletin, Vol. XX, Nos. 4--6.

Central Park Menagerie, New York, Report.

Academy of Natural Sciences, Davenport, Iowa: Proceedings, Vol. V, part 1.

Naturforschenden Gesellschaft, Emden: Jahresberichte 72--73.

Académie des Sciences, Arts et Belles-Lettres, Dijon: Mémoirs, Vol. X.

Societa Adriatica di Scienze Naturali, Trieste: Bollettino, Vol. XI.

Société Linneenne du Nord de la France, Amiens: Bulletin Mensüel, Jan.--Dec. 1888.

PROF. L. R. GIBBES, President of the Society, sent for exhibition an autograph of the late Eugene Chevreul, accompanied by the following interesting note:

Recent journals have announced the death of EUGENE CHEVREUL, the distinguished Chemist, on the 9th instant, at the advanced age of 102 years and 7 months. I have thought that it might interest the members of our Society to see his autograph signature officially affixed, more than fifty-two years since, to a letter of thanks addressed to me by the Museum of Natural History of Paris.

After taking the degree of M.D. in the Medical College of this City, in March, 1836, I sailed from New York for Havre in June of same year, in order to continue my studies in Paris, carrying with me a collection of many of the plants of South Carolina, and another of marine and fresh-water shells of the Southern Atlantic States. These specimens I exchanged with the French and German Naturalists with whom I became acquainted in Paris. Dr. J. E. Holbrook, Professor of Anatomy in our Medical College, had given me a letter of introduction to M. Valenciennes, one of the Professors at the Museum of Natural History, his former fellow student at the Garden of Plants, and through M. Valenciennes I presented a part of my collection of shells and plants to the Museum of Natural History, and from that Institution received many specimens of plants and shells in exchange. My Herbarium has suffered from attacks of insects, but many specimens still bear labels with the printed line "Ex Herb. Mus. Par.". I also thus became personally acquainted with several of the Professors and Aides at the Museum, among them Messrs. Valenciennes, Adrien de Jussieu, Guillemin, Dumeril, Bibron, and Adolphe Brongniart. Among the specimens sent by me to the Museum, were those of two species not before received by the

Museum, these were *Unio spinosus* and *Unio Shepardianus*, recently named by Mr. Lea, and for which this letter of thanks I now show you was sent to me while in Paris, signed by M. Chevreul, Director, and by M. Adolphe Brongniart, Secretary.

Dr. Richard Harlan, a distinguished naturalist of Philadelphia, whose acquaintance I there made in May, 1836, intrusted me with specimens of the *Axolotl* of the Lake of Mexico, then rare in European collections. These I carried, if I recollect rightly, to Prof. Dumeril, with a letter from Dr. Harlan.

Among the Professors whose lectures I attended were Gay Lussac and Chevreul at the Garden of Plants, Dumas and Pouillet at the Sorbonne, Broussais and Andral at the Ecole de Médecine, Velpeau, Roux, Bouillaud, Louis, Majendie, Biett, &c., at the different Hospitals. Of these M. Eugene Chevreul is, I believe, the last.

Charleston, April 24th, 1889.

The President submitted specimens with the following

Notice of Stalactites formed in Artificial Structures.

BY PROF. L. R. GIBBES.

I PLACE on the table, for the inspection of the members of the Society, a small box containing fragments of Stalactites found depending from an arch under a part of a building in this City.

The occurrence of Stalactites in similar situations is mentioned in works on mineralogy and geology, and the late Dr. Edmund Ravenel, informed me some thirty years ago, that he had found several hanging from the roof of the arch of a culvert in St. Thomas Parish in this State, the culvert, if I recollect rightly, being under some roadway in that locality. The fact of such occurrence is, therefore, not new, but this is the first time I have had an opportunity of seeing them *in situ*, in an artificial structure, and probably very few of the members of our Society have seen even specimens of them.

My attention was called, about the end of November last, to the occurrence of these stalactites, by my son, who accompanied me a few days after to the place where he had discovered them. Workmen were then engaged in laying anew the foundations of the Cathedral at the N. E. corner of Broad and Friend Streets, which was burnt in the great fire of Dec., 1861, and we thus obtained access to the grounds. The floor of the portico on Broad Street is supported by an arched way running parallel to Broad Street, nearly East and West. This arched way is divided in the middle by a wall contributing to the support of the floor above. On entering the Western cavity we found a dozen or two of slender stalactites, 2 to 4 inches long, and 1 to 3 tenths of an inch in diameter, they were very brittle, and numerous fragments lay on the ground. The attempt to detach stalactites whole was unsuccessful, increasing the number of fragments on the ground and a small one only remaining in the grasp of finger and thumb. Singularly enough the best specimen obtained, was found lying on the ground, 5½ inches long and ¼ of an inch in diameter, but apex and base were wanting. Several stalactites were attached by broad bases to the roof above; and the surface of the bricks was covered here and there with a stalactitical deposit, 2 to 4 inches in diameter, and 1 or 2 tenths of an inch in thickness.

These fragments seem to be nearly pure carbonate of lime.

April 11th, 1889.

JUNE 26TH, 1889.

Dr. G. E. MANIGAULT in the Chair.

Koninklijke Akademie van Wetenschappen, Amsterdam: Verslagen en Mededeelingen, Afd. Naturkunde, 3e Reeks, Deel II--IV; Afd. Letterkunde, 3e Reeks, Deel IV.

Kaiserliche Akademie der Wissenschaften, Wien: Sitzungsberichte 1888, I Ab., Heft, 1--5; II Ab., *a*, Heft 1--7; II Ab., *b*, Heft 1, 3--7; III Ab., Heft 1--6.

Museum of Comparative Zoology, Cambridge: Bulletin, Vol. XVI, No. 4.

Royal Society, London: Proceedings, Nos. 278--9.

American Philosophical Society, Philadelphia: Proceedings, No. 129, and
Supplemental Register.

Museum Francisco-Carolinum, Linz: 74ter Bericht.

Kaiserliche Leopoldina-Carolina Akademie der Deutschen Naturforscher, Halle:
Marchand, Mikrocephalen-Gehirne, and
Brauns, Serapeums von Pozzuoli.

West American Scientist, San Diego, Cal.: No. 44.

Published May, 1890.

JULY 25TH, 1889.

Dr. G. E. MANIGAULT in the Chair.

THE Chairman exhibited a curious specimen which had been found in the neighborhood of a pile of phosphate rock, at the east end of Hasel Street, in this City, not far from several iron foundries and machine shops. Its general appearance, where the surface has not been bruised, is that of a coprolite, and if it is one, it is a part of the excrement of either an elephant or a mastodon. Its shape is a truncated cone with the smaller end rounded, and the base has been rubbed or ground artificially, so as to present a flat surface upon which the specimen rests without difficulty. The entire unbruised surface is black, which proves it to have been dredged from one of the adjacent rivers.

Dr. Manigault suggests that it is probably the concluding part of a voiding effort of one of the animals mentioned, and thinks that the explanation of the fact of the base being ground is, that it was doubtless used by the workmen in one of the shops to smooth off their grindstone, and had been mislaid when discovered on an adjacent pier. It has been placed among the local fossils in the College Museum.

AUGUST 22D, 1889.

Dr. G. E. MANIGAULT in the Chair.

The following communication was read:

Additional Note on Pieris monuste.

BY ELLISON A. SMYTH, JR.

THIS Spring (1889) *Pieris monuste* was quite abundant in the City. I first noticed a male and several females in April, from which time on, until the middle of July, when I left the City they gradually increased in abundance. The females were nearly all of the smoky type. and I observed two forms of coloring, both equally abundant. A very noticeable feature was the fact that nearly without exception, all that I saw were flying from West to East. They continued their flight along the wharves and apparently crossed over the harbor. This was noticed day after day, and yet they could not have been migrating, for I found them breeding. The flight is steady and firm and quite rapid, like that of *Callidryas eubule*, and only occasionally did I notice them hovering over flowers. A clump of Japan Privet trees in bloom seemed attractive, and on this I occasionally saw them light, and once I saw two females feeding on clover blossoms. All others seen were in flight, and I only succeeded in capturing specimens by standing in the line of flight and dashing my net at them as they passed. On July 7th pupæ were brought to me; they had been taken from the stems of millet and in angles in the wall of a green house. My informant was sure that no *Cruciferæ* were in the neighborhood, and I was unable to verify his statement, but presume that this was a mistake, and that mignonette or something of the kind grew near. The chrysalis is pale whitish yellow, marked with black, and has two black filamentous spines, projecting, one from either side, at the position occupied by the posterior angle of the wings.

OCTOBER 24TH, 1889.

Vice-President **Archer** in the Chair.

Books Received.

Museum of Comparative Zoology, Cambridge: Bulletin, Vol. XVI, No. 5; Vol. XVII, No. 4; and Vol. XVIII, and
Memoirs, Vol. XIV, No. 1, parts 1 and 2.

California Academy of Sciences, San Francisco: Proceedings, Vol. I, parts 1 and 2.

Journal of Comparative Medicine and Surgery, Vol. X, Nos. 3 and 4.

West American Scientist, San Diego, Cal.: No. 45--47.

Oberhessiche Gesellschaft für Natur- und Heilkunde, Giessen: 26ter Bericht.

Royal Society, London: Proceedings, Nos. 280--282.

Royal Dublin Society: Transactions, Vol. IV, and Vol. VI parts 3--6.

Physikalisch-Medicinische Gesellschaft, Würzburg: Sitzungsberichte, 1888.

Colyer Meriwether, History of Higher Education in South Carolina *From Hon. M. C. Butler, M. C.*

36TH ANNIVERSARY MEETING.

NOVEMBER 28TH, 1889.

Vice-President H. P. ARCHER in the Chair.

Capt. F. V. ABBOTT. U. S. Corps of Engineers, having consented to address the Society this evening on Jetty work in general, with special reference to the important works now under his charge in Charleston Harbor, the routine business of the meeting was postponed until December 26th.*

DECEMBER 26TH, 1889.

Dr. G. E. MANIGAULT in the Chair.

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* Capt. Abbott having spoken without notes, and the demands upon his time and attention having been too great to admit of his since writing it out, it is impossible, at this time, to publish his very entertaining and instructive address.

Books Received.

Kansas Academy of Sciences: Transactions, Vol. X.

Reale Instituto di Studi Superiori, Firenzi:

Antonio Roiti, Osservazioni della Elettricita Atmosferica.

Georgio Pellizzari. Archivio della Scuola d'Anatomia Patalogica.

Luigi Luciani, Linee Generali della Fisiologia del Cervelletto.

Angiolo Filippi, Esegesi Medico Legali sul Methodus Testificandi di Giovan Battista Codronchi.

West American Scientist, San Diego, Cal.: No. 48.

Royal Society, London: Proceedings, No. 283.

Elisha Mitchell Scientific Society, Chapel Hill, N. C.: Journal, 1889, part 1.

Boston Society of Natural History: Proceedings, Vol. XXIV, parts 1 and 2.

Museum of Comparative Zoology, Cambridge: Bulletin, Vol. XVII, No. 5.

The Chairman exhibited a blue print chart of one of the "Big Trees" of California, which he had received from Mr. R. H. Lucas, Jr., of San Francisco, from which it appeared that the germ had vitalized A. D. 620.

Mr. Mazÿck exhibited specimens of the recently described *Pupa rugosula*, STERKI, from Sullivan's Island, S. C.

The following paper was read:

"RAINING" TREES.

BY WILLIAM SCHLEPEGRELL, M. D.

ON December 2d, 1889, my attention was called by an article in the *Deutsche Zeitung*, to the phenomenon of a "raining tree" at the Schuetzenplatz, near the City boundary. Having frequently seen notices of similar phenomena, with theoretical opinions as to their cause and origin, but with a minimum of facts from which a scientific theory could be deduced, I made a series of observations which I beg to report.

December 3d, 1889, 1.40 P.M.; Thermometer, 67°; Barometer, Weather Fair. I found the tree, of which the phenomenon is reported, West of the dance-hall at the Schuetzenplatz. It is an old, but healthy, Live Oak, (*Quercus virens,*) the trunk of which measures 9 ft. 4 in. in circumference, 2 ft. above the base, and the leaves, green and vigorous, are most abundant on the outer ends of the branches. This tree is one of a group of four, the others being two Cedars, (*Juniperus virginianus,*) and a second Live Oak ; the two Cedars being respectively West, (No. 1,) and North West, (No. 2,) and the Live Oak, (Oak No. 2,) South West of the first tree, (Oak No. 1). Near the foot of Cedar No. 1, grows an enormous wild grape vine, the trunk measuring 3 ft. 2 in. in circumference 18 in. above the base. This vine soon divides into three trunks, one, the largest, passing among the branches of Oak No. 1, and the other two, much smaller in size, passing among the branches of Oak No. 2 and Cedar No. 2, the Cedar, at the foot of which the grape vine grows, containing none of the branches.

Regarding the phenomenon, the drops of "rain" could be felt as they fell ; they could be seen glistening in the air as they descended, and the drops which had fallen could be seen on the benches surrounding the base of the tree. I noted that the drops did not fall in like numbers in all parts of the ground under the tree. The largest number fell near the base of the tree on the West side ; the next in number fell around the base of the tree, from North through East to West. Under the branches extending North and East no drops could be felt or seen, beyond a circle of 8 ft. from the base of the tree, although the branches extended 38 ft. North, and 32 ft. West. Oak No. 2 showed only a few drops, these being on the North East side. Under Cedar No. 1 no drops could be found, but under Cedar No. 2, drops could be seen on the benches under the South East branches of the tree.

I selected a number of branches from Oaks No. 1 and No. 2, and Cedars No. 1 and 2, in order to compare their structure microscopically.

I made an examination of the other trees on the grounds to see if any drops could be found under them, but none of them exhibited the phenomenon.

December 6th, 1889, 3.35 P. M. ; Thermometer 62° ; Barometer, Weather Slightly Cloudy.

I visited the tree in company with Mr. W. G. Mazyck and found the tree "raining" as on the 3d inst. Examining the tree for insects, we found a few lepidoptera, one-quarter of an inch in length, in the pupa state, and enclosed in their cocoons. The small number that we found were attached to the under surface of the leaves. A single specimen of *Locusta* was found on a branch. We tested the drops which fell under the two Oaks and Cedar No. 2 and found them slightly acid, just sufficiently so to change the color of blue litmus paper. We tasted them, but the taste, if any existed, was too weak to be perceived.

We directed the keeper of the grounds to make observations in order to ascertain whether any variation existed in the fall of the drops during the day and night.

December 7th, 1889, 1.40 P.M.; Thermometer, 66°; Barometer, Weather Fair.

Careful microscopical examination has failed to show any difference in the leaves and branches of the Oaks or Cedars. The keeper of the grounds reported that the drops continued to fall during the entire day and night, being greater in number and size during the night. I examined the locality from which the drops appeared to fall in the greatest abundance with a field glass, and saw that the drops, where they could first be seen, were larger in size and less in number, being broken in their fall by the resistance they met in the lower leaves and branches. Although the glass was quite strong, and the lower surface of the leaves could be distinctly seen, the most careful scrutiny failed to reveal any liquid adhering to them.

The leaves of Oak No. 1 formed a kind of canopy which might cause the enclosed air to have a lower temperature than the surrounding air, and thus cause a condensation of moisture and a falling of the drops. To test this, a large fire was kindled under the tree, which soon raised the temperature of the air several degrees, but this experiment had no effect on the falling drops.

A ladder was procured and a young man volunteered to climb to the top of the tree. By the assistance of the glass he was directed to the locality from which the drops fell in the greatest number, a point about 65 ft. from the ground. He found, intertwining with the branches of the Oak, branches of the grape vine, the leaves of which had fallen, owing to the lateness of the season. After a close search he found a branch, the leaves of which contained a considerable amount of liquid on the upper surface. Passing in all directions, above and below this point, were the branches of the grape vine, which were also moist in certain parts.

Some of the oak leaves containing the liquid, and some of the moist branches of the grape vine were detached and brought down and the liquid found on them compared with the drops on the benches. Their chemical reaction and taste were found to be the same. A closer examination showed that the moisture on the grape vine extended, as a rule, about two inches above and below a bud, and that the branches were full of sap although the leaves had already fallen.

December 9th, 1889, 2.30 P. M.; Thermometer 64°; Barometer, Weather Cloudy.

The trunk of the grape vine, leading to Cedar No. 2, was cut. Near the central portion of the top of Oak No. 1, a bottle, *a*, was attached to a moist branch of the grape vine at a point where a bud grew, and another bottle, *b*, was fastened to a similar part of another branch. We next cut a branch of the grape vine and passed the root end into a third bottle, *c*. A fourth bottle, *d*, was attached to another cut branch of the vine.

December 10th, 1889, 3.20, P.M.; Thermometer, 70°; Barometer, Weather Fair.

No drops could be seen falling or on the benches under Cedar No. 2, where grape vine had been separated from its root. The four bottles and the branches to which they were attached were brought down and examined. Bottles *a* and *b* contained each about 3 c.c. of a liquid which had the same chemical reaction and taste as the drops found on the leaves and benches. Bottle *c* was empty, examination showing that it was tied to the wrong end of the cut vine.

Bottle *d* contained about 5 c.c. of a liquid which had a slightly more acid reaction and taste than the liquid found in bottles *a* and *b*.

The legitimate deduction to be made from these observations is, that the source of the drops, in this case, is the grape vine. This has been an unusually warm Autumn, as shown by the thermometrical reports taken on the days that the observations were made. The frost and cold weather, which we had earlier in the season, have shorn the grape vine of its leaves, and the subsequent warm weather has caused the sap to continue to flow into its branches. This, instead of causing a premature development of the buds, to be destroyed by the first frost, passes out, by some provision of Nature, at or near the bud. This liquid falls on the upper surface of the Oak leaves and remains there until the quantity becomes too great for the leaf to support, or until it is disturbed by the action of the winds. It then rolls off, breaks into a number of small drops from the resistance of the air or the leaves and branches which it meets in its path.

Tests and close observations have allowed us to exclude the condensation of moisture in the atmosphere and the action of insects, and have permitted us to trace the liquid from the ground to the leaves, and thence to the grape vine. Over every point where the leaves were found to hold the liquid, the grape vine could be seen passing in more or less abundance. The grape vine did not extend into the North East parts of the Oak tree, and under these portions of the tree no drops could be found. The cutting of the trunk that supplied the Cedar and the subsequent complete cessation of the fall of the drops under this tree, corroborates the facts already learned from the liquid found in the bottles attached to the branches of the second trunk of the grape vine, that is, that the grape vine is the source of the drops and the cause of the phenomenon of this "Raining Oak".

December 21st, 1889.

Since writing the above article, my attention was called by Mr. J. C. H. Claussen to a "raining tree" at his farm, about four miles from this City. This farm is leased by Mr. Charles Bencken, who kindly showed me the tree, examination showed, however, that the "rain" was not restricted to the tree which I had come to see, but that not less than ten trees exhibited this phenomenon. Adjoining the stable of the farm yard, there are four Catalpas (*C. bignonioides*) from each of which the drops could be felt and seen, although comparatively few in number. In the drive leading to the farm yard, there are four Linden trees (*Tilia Americana,*) under which the drops could be felt to such a degree that one was instinctively led to look at the sky to see if it was not raining in reality. The tenant of a neighboring house, who has recently moved into this locality, informed me that the children had come into the house repeatedly to tell her that "it was raining" which had caused her much surprise, as she did not know of the existence of the "raining trees". In the garden of the farmhouse, I found two Magnolias (*M. grandiflora*) from which the falling drops could also be felt, though less in number. As these trees were only about 25 ft. in height, I procured a ladder, which two men held in a perpendicular position adjoining the trunk of the Linden tree, so that I could mount it and examine the branches closely. Here the whole process was plainly visible. The drops could be seen slowly exuding from the branches, around the buds, until its weight overcame its adhesive power, when it would fall and separate into several smaller drops from the resistance which it met in its path.

In each of these cases I found a condition similar to that of the grape vine as described above. Owing to the lateness of the season and to the cold weather which we had earlier in the Autumn, the leaves of these trees had all fallen. By reason, however, of the unusually warm weather which we have had for several weeks past, the trees are full of sap which made its exit in the manner described. The existence of such a large number of specimens of "raining trees" within an area of half an acre shows that this, under favorable circumstances, is, by no means, an unusual phenomenon.

If this article shall cause more attention to be given to this interesting subject, so that we may obtain a more extensive knowledge as to the localities where this phenomenon occurs and by what trees it is exhibited, the writer will feel rewarded for his feeble efforts.

The following Officers were elected:

President,
HENRY P. ARCHER.

Vice-President,
G. E. MANIGAULT.

Corresponding Secretary,
WM. SCHLEPEGRELL.

Recording Secretary and Treasurer,
WM. G. MAZŸCK.

Librarian,
LEWIS R. GIBBES.

Curators,

Wm Schlepegrell,
C. U. Shepard,
G. E. Manigault,
J. K. Blackman,
Wm. G. Mazyck,
Thomas Royle,
E. A. Smyth, Jr.
C. B. Colson.

Published July, 1890.

Prof. Gibbes, after most faithful service as President for 37 years, declined re-election, as did also Dr. Chazal.

JANUARY 23D, 1890.

The President in the Chair.

Books Received.

Journal of Comparative Medicine and Veterinary Archives, Vol. XI, No. 1.

American Philosophical Society, Philadelphia: Proceedings, Vol. XXVI, No. 130.

Museum of Comparative Zoology, Cambridge: Reports, 1888--9.

Kaiserliche Akademie der Wissenschaften, Wien: Sitzungsberichte, I Ab., 1888, Heft 6--10, 1889, Heft 1--3; II Ab, *a*, '88, Heft 8--10, '89, Heft 1--3; II Ab., *b*, '88, Heft 8--10, '89, Heft 1--3; III Ab., '88, Heft 7--10, '89, Heft 1--4, and

Register No. 12,

Dr. Manigault exhibited a skull of *Chinchilla lanigera* from Chili.

Dr. Schlepegrell exhibited a portion of a fossil skull of a Xiphoid Whale, and an undetermined molar tooth, from the Phosphate beds in the vicinity of Charleston.

A letter of resignation from Dr. C. F. Panknin was read and accepted.

FEBRUARY 27TH, 1890.

The President in the Chair.

Dr. MANIGAULT, referring to the skull of the Chinchilla, *Chinchilla lanigera*, exhibited by him at the last meeting of the Society, stated that he had observed some peculiar features in the osteology of the species, which are not mentioned by either Yarrell or Owen.

MARCH 27TH, 1890.

The President in the Chair.

A letter of resignation from Dr. Wm. Schlepegrell was read and accepted with regret, Dr. C. B. Colson was appointed Corresponding Secretary, and Dr. Schlepegrell, having removed to New Orleans, was elected a Correspondent.

APRIL 24TH, 1890.

The President in the Chair.

Books Received.

Essex Institute, Salem: Bulletin, Vol. XXI, Nos. 7--9.

Journal of Comparative Medicine and Veterinary Archives, Vol. XI, Nos. 3 and 4.

Smithsonian Institution: Reports, 1886--7.

Museum of Comparative Zoology, Cambridge: Bulletin, Vol. XVI, Nos. 6 and 7; Vol. XVII, No. 6; and Vol. XIX, No. 1, and Memoirs, Vol. XVI, No. 3, and Vol. XVII, No. 1.

Royal Society, London: Proceedings, No. 284--7.

Minnesota Academy of Natural Sciences, Minneapolis: Bulletin, Vol. III, No. 1.

Société Linnéenne du Nord de la France, Amiens: Mémoirs, Tome VII.

Académie des Arts, Sciences, et Belles-Lettres, Dijon: Mêmoirs, 4me Sèrie, Tome I.

Department of Public Works, New York City: Report of the Central Park Menagerie.

Mr. Mazyck mentioned the occurrence of *Stenogyra decollata*, L., at Aiken, S. C., where he had found it in moderate abundance in February last. It does not there attain the size of Charleston specimens. This is the only locality in continental North America, other than Charleston, known to him, in which the species has obtained a foothold.

MAY 29TH, 1890.

The President in the Chair.

Books Received.

Bibliotheca Entmologica, Vol. X.

Royal Society, London: Proceedings, No. 288.

Journal of Comparative Medicine and Veterinary Archives, Vol. XI, No. 5.

Museum of Comparative Zoology, Cambridge: Bulletin, Vol, XIX, No. 2.

Medical and Surgical Journal, Atlanta, Ga.: Vol. VII, No. 3.

Elisha Mitchell Scientific Society, Chapel Hill, N. C.: Journal, 1889, part 2.

Colyer Meriwether, History of Higher Education in South Carolina. *From Hon. Wade Hampton, M. C.*

From Hon. M. C. Butler, M. C.:

Report of the Bureau of Ethnology, 1882--3.

Report of the Commissioner of Labor, 1888.

Washington Observations, 1884, and

Consular Reports, parts 1 and 2.

The following paper was read:

Notes on the Osteology of Chinchilla lanigera.

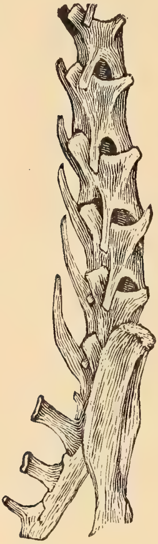
BY G. E. MANIGAULT, M. D.

I HAVE lately had in my possession a live Chinchilla which was brought to this port in an English steamer arriving from Chili. The animal was a male and appeared to be in good health, but among the several articles of food offered it, including nuts, almonds, etc., there was nothing sufficiently tempting to induce it to make a hearty meal. Of bread crumbs it perhaps ate more than of everything else. It had not been sufficiently tamed to be handled with impunity, and when disturbed with pieces of food, which it refused, it was in the habit of making a movement with one of the fore feet which was peculiar and unusual. It was a lateral, outward jerk of the foot, indicating impatience and desire to get rid of the object which annoyed it, and which was repeated whenever the attempt was again made to force it to eat. The existence of a clavicle as one of its bones was easily surmised by the possibility of this little movement.

It lost flesh from the day it came into my hands, and died from weakness more than from any other cause, at the end of a fortnight. An autopsy of its more important organs revealed no diseased condition, and there was no injury to any part of its skeleton.

A careful reading of the descriptions of the animal which were at hand seemed to be conclusive as to its being *Chinchilla lanigera*, but an inspection of its skeleton would lead to the belief that it may be either a new variety, or that there are certain variations in its osteology which, if not sufficient to class it as such, are nevertheless sufficiently important to be noticed.

The first of these is the remarkable inclination forward of the neural spines of the lumbar vertebræ. This has not been noticed by Owen in his work on the Anatomy and Physiology of Vertebrates, although it is much greater than in the Jerboa, a little rodent from Africa, which with the Chinchilla, is the only other member of the family *Jerboidæ.* This inclination forward is but slight in the Jerboa, as compared with the Chinchilla, but Owen has mentioned it only with reference to the first. It has been represented in the accompanying woodcut.


Side view of Pelvis, with Sacral and Lumbar Vertebræ.

The second of these variations is the existence of three sacral vertebræ instead of two as described by Yarrell in the Proceedings of the Zoological Society of London for 1830–31. This is believed to be the first printed description of the animal, but I am told by Prof. Oldfield Thomas, of the British Museum, (Nat. Hist.), that they have a skeleton of Chinchilla in their collection which also shows three sacral vertebræ. These can also be seen in the same woodcut.

The third and most striking variation is a crescent shaped flat bone occupying the anterior half of the outer edge of the external meatus of the ear.

The skull of my specimen only shows this bone on the side. This is due to the one on the right side having heen cut away with the skin when this was being rougly removed preparatory to the preparation of the skeleton, and the next day, when, on further work upon the head, the existing bone was observed, it was too late to recover the missing one.

It is a perfectly healthy ossification and is attached to the skull ligamentously. After a short soaking in water it again becomes slightly movable on the skull, as it was in life. It is well shown in the woodcut, and another drawing, twice the size, is added. It seems remarkable that it never was noticed either by Yarrell or Owen, the latter of whom gives two life-size woodcuts of the head in his work already mentioned.

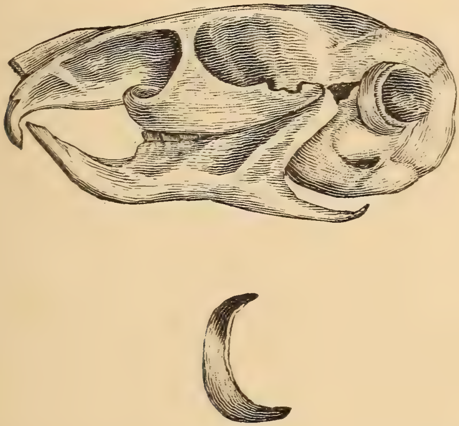
Before proceeding to give an opinion as to the purposes of this bone, I have taken the precaution to write to several naturalists of known reputation, including Mr. J. A. Allen, of the American Museum, New York City, who kindly examined the Zoological Record for twenty-five years in a vain search for a notice of the bone, and Mr. G. B. Howes of London, England, who replies that he is familiar with it "and with its like in other *Hystricomorpha.* There are two such in *Cavia*, and I believe them to be ossifications of the cartilaginous meatus externus".

With regard to a description already in print, Mr. Howes says that he is not familiar with any such, and Prof. O. Thomas says: "Like him (Mr. Howes) I have seen the extra ear-bone myself, but cannot remember where there is a description of it. I have, however, a strong impression that I have seen it described somewhere, but by whom, and in what particular animal I cannot recall".

With these doubts as to the existence of a description already inprint, I have concluded to prepare this account of what I have observed for this Journal, notwithstanding the possibility of another being eventually discovered.

I will add that I have submitted the bone to Dr. Middleton Michel, of the Medical College of South Carolina, and that he believes "it to be a relic of embryonal development, representing the tympanic bone, which has only partially coalesced with the petrosal, still retaining its ring-like appearance".

A moment's examination of the Chinchilla skull shows an enormous development of the cavities connected with the mechanism of hearing, thus intensifying the sound which enters said cavities. In addition to this the external ear is unusually large — more so in fact than in probably any other animal of the same size now living. With these two conditions the sense of hearing in the Chinchilla must be necessarily very acute.



Skull of CHINCHILLA LANIGERA, with view of bone attached to ear twice its natural size.

With regard to its purpose, my opinion is that it is not an ossification of the cartilaginous meatus internus, as that is a part of the petrosal, which is soft in early life and becomes joined to it later by ossification, whereas this bone is entirely separate and distinct. Its size is such that it should not escape the notice of a careful dissector, and it is an important detail of the skull whether seen from above or from the side. It doubtless exists in other rodents, although perhaps never so large in proportion to the head as in *Chinchilla*. Its purpose would appear to be for the more secure attachment of the large external ear, which a dissection of the adjacent soft parts will most likely prove to be true.

JUNE 26TH, 1890.

The President in the Chair.

The following paper was read:

THE SEASON OF 1889-'90.

BY J. K. BLACKMAN.

In accordance with a suggestion made at the March meeting of the Society, I have collected some data touching the recent remarkable season and its effects upon the flora of Charleston. But before going into results, it may be well to record the facts which illustrate how abnormal have been the meteorological conditions for the six months ending April 30, 1890.

Taking up first the subject of temperature, it will be seen by an examination of the following table, compiled from the Monthly Reports of the United States Signal Office at this place, that while there was an enormous excess in January and February, there was an actual deficiency in the temperature of the month of March of 39°, as compared with the normal temperature of that month for fifteen years past.

	JANUARY.	FEBRUARY.	MARCH.	APRIL.
Mean Temperature of the month,	59°	61°	56°	65°
Average Mean Temperature for fifteen years,	50°	52°	57°	64°
Excess of temperature for the month,	284°	214°		13°
Deficiency of temperature for the month,			39°	
Lowest temperature,	36°	39°	25°	47°
Date of lowest temperature,	17th	10th	16th	2d
Total excess of temperature, January 1st to April 30th, 472°				

It is also noteworthy that the minimum temperature for March, 25°, was lower than at any time for the same period since 1874, when the self registering thermometer was established at this station, and as no record was kept of the minimum temperature up to that time, it is impracticable to tell how long a period has elapsed since the temperature of March has reached so low a point as this. On March 2d, 3d, and 9th the mercury fell below the freezing point. The following is a record of the minimum temperature for the month of March from 1874 to 1890, inclusive:

1874,	37°,	1875,	35°,	1876,	28°,
1877,	32°,	1878,	41°,	1879,	35°,
1880,	40°,	1881,	33°,	1882,	40°,
1883,	36°,	1884,	34°,	1885,	34°,
1886,	30°,	1887,	34°,	1888,	30°,
1889,	34°,	1890,	25°.		

As remarkable as was the departure of temperature from the normal for the six months ending April 30th, 1890, the deficiency in rainfall for the same period was no less extraordinary. In January the deficiency was 2.93 inches; in February it was 2.31 inches; in March 2.46 inches; and in April 1.87 inch, making a total deficiency of rainfall, from January 1st to April 30th, of 9.57 inches as compared with the normal precipitation for the past fifteen years.

A glance over these figures will show at once that the unfavorable effect of the season upon plant life has been due mainly, if not entirely, to the abnormal excess of temperature during the Winter months, and the sudden and unusual deficiency of temperature in the month of March, aided no doubt by the accompanying deficiency in precipitation.

Going back as far as November 1st, 1889, the period when vegetation usually enters upon its period of rest, and the life giving sap ceases its activity, we find an excess of temperature for the month of 76°, and an excess of rainfall, over the normal for fifteen years, of 4.20 inches. Heat and moisture, the two most important conditions for the development of all organic life being present, the plants postponed their retirement from active life and put on a new growth.

In December following, instead of the usual withdrawal of heat to be expected in that month, the *excess* of temperature was 276°, as compared with the normal for fifteen years, Thus from month to month plant life was prevented from passing into a dormant state, and in the early part of February Tea roses, especially those of a climbing habit, were in full bloom, two months and a half in advance of their usual blooming period. In fact it may be truly said that, from the Spring of 1889, to the early part of March, 1890, Charleston gardens were continuously in bloom, with the exception of about two weeks in November, 1889.

The Hybrid or Remontant type of roses bloom, with some few exceptions, only once a year, and their usual blooming period, in Charleston, is from April 15 to May 15. They are deciduous plants and, as a rule, do not put forth their new leaves until awakened from their long sleep by the boisterous winds of the vernal equinox. But during the past season Remontant roses put forth their new shoots in December, and a few varieties, such as John Hopper and Paul Neyron, put forth a few blooms in February. By the 1st of March the plants were in full bud and their new green shoots were as full of sap as they usually are a month and a half later. Then, on the March 2d, came the first rude check. The thermometer fell suddenly, within a few hours over 40°, and touched 29°, but remained below the freezing point only about 30 minutes. The next morning the temperature fell to 28°, but, as on the day previous, rapidly rose above the freezing point and remained above 50° until the morning of the 9th, when there was another sudden decline to 32°, accompanied by the heaviest fall of snow seen in Charleston for many years. Even after this last freeze the plants in the City gardens exhibited little or no signs of serious damage, and even so tender a shrub as the heliotrope remained alive in the open air, but one week later, on the 16th, came the killing frost, when the temperature fell to 25° and remained far below the freezing point for several hours. The next morning the gardens looked as if they had been swept by fire; orange trees which a few hours before had been rejoicing in a wealth of tropical foliage, hung limp and blasted, and thousands of rose buds which were ready to burst into magnificent color and fragrance, hung their heads in death. Truly it was a slaughter of the too confiding little innocents.

As to the Tea roses, the loss of their buds meant simply a delay of bloom until they could recover from the shock and put forth a new crop, but with the Hybrid roses it was a more serious matter. The great majority of this class produce only one crop of roses a year, so that when the crop was killed their bloom for the year was over. I cut back the bud-bearing shoots of about one-half of the Hybrid roses in my garden ; the other half I left untouched. Of those I cut back, the Magna Charta, Antoine Mouton, and Paul Neyron were the only types which put forth new flower-stems. The others, as soon as the temperature warranted it, put forth new shoots, but they were entirely flowerless. Those which I left uncut, in the majority of cases, produced flowers of a very inferior quality, mostly mishapen, off color, and undersize. Others did not bloom at all. This experiment satisfies me that, with the exception of a very few varieties, the Remontant roses, like peach and pear trees, when deprived of their buds in the Spring make no further effort to produce blooms until the following Spring. Magna Charta, Antoine Mouton, Paul Neyron, and perhaps a few others of similar habits, are exceptions to the rule, because like some fruit trees, they produce a second bloom after the first Spring bloom is over, and the Paul Neyron frequently blooms moderately at intervals throughout the Summer, especially if the season is a wet one. The Hybrid-Tea roses which possess the ever-blooming quality of the Tea roses with the magnificent flowers of the Hybrids, were affected only as the Tea roses were and, except in cases where the plants were killed by the sudden check, the lost crop of buds was very soon replaced by another, but the effect upon all classes of roses was either to destroy the bloom for the season, or to delay it three or four weeks. So it was that at the Floral Exhibition of the Agricultural Society of South Carolina, held on the 8th and 9th of May, two weeks later than usual, the display of roses was so poor that the Judges decided to give no first premium at all.

The loss of the Spring bloom was not the only disaster which the unusual season brought upon amateur rose growers. The fall of temperature on the 16th of March was so sudden and so severe that the sap laden shoots were split in many instances down to the main stalk, like so many water pipes, and the plants sickened and died by the hundred. It is somewhat remarkable that the greatest loss occurred among the Remontant roses, which are regarded as perfectly hardy and live through the Winters of the frozen North without protection. On the other hand the Tea and Hybrid-Tea roses, which are not hardy and survive the Northern Winters only in hot-houses, suffered comparatively very little damage. Nor were amateur gardeners the only sufferers. Mr. P. J. Berckmans, the celebrated Southern florist, while in Charleston a few weeks ago, said that the past season had been the most disastrous to his plants within his memory. Out of 150,000 rose plants which he had set out into his open-air nurseries, he had lost, he said, fully 140,000.

All varieties of plants were more or less affected by the season, and in some cases their usual habits were completely changed. Gladiolus bulbs, which usually shoot above the soil about the middle of April, and bloom in May and June, were blooming in the early part of March. Those which had not yet bloomed up to the time of the March freeze, were so far advanced that they were cut down, and, except in a very few instances, their blooms for the year were destroyed. So it was with Lilies and Amaryllis. The Bermuda Easter Lily, which is seen in almost every Charleston garden, and which usually blooms here about the middle of May, was in full bud at the time of the March freeze, and in my garden I did not get a single bloom. I have seen a few of these Lily blooms in other portions of the City ; the plants were probably not so far advanced as mine and the flower germ had not formed.

Even the hardy Nereum, or Oleander, which was in full bud on the 1st of March, was cut back and is now just putting forth new blooms.

Chrysanthemums, which bloom ordinarily about the 15th of November, have been so much perplexed by the vagaries of the season that many varieties are now in bud, and I have some in actual bloom in my garden, six months ahead of time. Of course the blooms are very imperfect, and by cutting the plants down now they will, in all probability, put out a crop of flowers in the Fall, at their usual blooming time.

Even within the green-houses the effect of the season has been felt. For the first time in many years the Pelargonium Geraniums have failed to bloom except in some few isolated cases. Zonales, on the other hand, have bloomed as beautifully and as profusely as usual.

The deficiency in rainfall during the season was not without its damaging effect upon the gardens, and, after the freeze, the drought furnished the proper conditions for an attack from mildew, red spiders, and caterpillars, which injured the rose plants materially. Happily the recent rains have driven these pests away and the florist can now look forward to repairing his fortunes.

Should the conditions of the past season be duplicated, I think that the

Spring crop of roses may be saved by cutting back the plants in February; before the flower buds have formed, and by keeping the plants cut back until all danger of frost is over. This plan would bring the roses into bloom about a month later than the usual blooming period. In fact, there is very little doubt that if Charleston rose growers would trim their Hybrid roses in November, and then cut them back again in February, every year, so as to avoid the invariable frosts of March and early April, the Spring bloom would be much more perfect.

While the season of 1889-90 has been a trying one upon the patience and enthusiasm of the amateur, it must be remembered that it was a phenomenal season and not likely to be duplicated in many years. In the language of the Rev. Reynolds Hall, the great rose grower of England, I may be permitted to say that "He who would have beautiful Roses in his garden must have beautiful Roses in his heart. He must love them well and always. To win he must woo, as Jacob wooed Laban's daughter, though drought and frost consume. He must have not only the glowing admiration, the enthusiasm, and the passion, but the tenderness, the thoughtfulness, the reverence, the watchfulness of love. With no ephemeral caprice, like the fair young Knight's, who loves and who rides away when his sudden fire is gone from the cold white ashes, the Cavalier of the Rose has *semper fidelis* upon his crest and shield. He is loyal and devoted ever, in storm fraught as in sunny days; not only the first upon a Summer's morning to gaze admiringly on glowing charms, but the first, when leaves fall and winds are chill to protect against cruel frost. As with smitten bachelor or steadfast mate, the lady of his love is lovely ever, so to the true Rose grower must the Rose-tree be always a thing of beauty. To others, when its flowers have faded, it may be worthless as a hedge-row thorn; to him in every phase it is precious. 'I am no more the Rose,' it says, 'but cherish me, for we have dwelt together'; and the glory which has been and the glory which shall be, never fade from his heart."

37TH ANNIVERSARY MEETING.

NOVEMBER 27TH, 1890.

Dr. G. E. **Manigault**, Vice-President, in the Chair.

Books Received.

Medical and Surgical Journal, Atlanta, Ga.: Vol. VII, Nos. 4--9.

Museum Francisco-Carolinum, Linz: Berichte, 1888--9.

American Chemical Society, New York: Journal, Vol. XII, No. 7.

Académie Royale des Sciences, Amsterdam: Verslagen en Mededeelingen, Afd. Naturkunde, 3 Reeks; Afd. Letterkunde, 3 Reeks.

Entomological Society, Brooklyn: Entomologica Americana, Vol. VII, No. 10.

Academy of Sciences, St. Louis: Journal, 1889.

American Philosophical Society, Philadelphia: Proceedings, Nos. 131--3.

Museum of Comparative Zoology, Cambridge: Bulletin, Vols. XIX, No. 4, and XX, No. 2.

Society of Science, Letters and Arts, London: Transactions, Sep., 1888--Nov., 1889.

Natural History Society, Folkstone: Proceedings, 1884--9.

West American Scientist, San Diego: Nos. 50--53.

Philosophical and Literary Society, Leeds: Reports, 1888--9.

Journal of Comparative Medicine and Veterinary Archives, Vol. XI, Nos. 6--11.

Naval Institute, Annapolis: Proceedings, Vol. XVI, and
Index to Vols. I--XV.

Elisha Mitchell Scientific Society, Chapel Hill, N. C.: Journal, 1890, part 1.

Royal Society, London: Proceedings, Nos. 289--92 and 294.

Essex Institute Salem: Bulletin, Vols. XXI, Nos. 10--12, and XXII, Nos. 1--3.

Natural Science Association, Staten Island, N. Y.: Proceedings to Nov., 1890.

Physicalisch-Medicinische Gesellschaft, Würzburg: Sitszungsberichte, 1889.

Oberhessichen Gesellschaft für Natur- und Heilkunde, Giessen: 27te Berichte, 1890.

University of Michigan, Calendar, 1889--90.

Johns Hopkins University, Hospital Bulletin, Vol. I, No. 7, and
Circular 83.

Naturforschenden Gesellschaft, Emden: Jahresberichte, 1889-90.

Canadian Entomologist, Vol., XXII, No. 11.

Nova Scotian Institute of Natural Sciences: Proceedings and Transactions, Vol. VII, parts 1--3.

Academy of Natural Sciences, Philadelphia: Proceedings, 1890, part 1.

Smithsonian Institution, List of Exchanges, and
Rules of International Exchange.

Colorado College Scientific Society, Colorado Springs: College Studies, 1890.

Government Reports, Large Collection.

The following paper was read:

THE ANNULAR PHASE OF VENUS.

BY PROF. LEWIS R. GIBBES.

An opportunity of observing an unusual, if not remarkable phenomenon, will soon occur, and I wish to call the attention of astronomers to it, as another opportunity will not present itself until after the lapse of eight years. This phenomenon may be conveniently called the annular phase of the planet Venus, though it be produced not by reflected light only, as in the ordinary phases of the moon, but partly also by the refracted light of the Sun, which has passed through the planet's atmosphere. This phase I unexpectedly witnessed 24 years ago under the following circumstances :

I desired to observe the *prolongations* of the cusps of the crescent of light, mentioned by several writers, and which I afterwards found had been observed by Mädler, in May, 1849, and used by him to obtain the amount of refraction in atmosphere of Venus ; but I had not then read his paper on the subject, and was unacquainted with his formulæ.

It was well known that if Venus and the Earth, at any time occupied certain relative positions in their orbits, they would return very nearly to the same points, after an interval of 8 years less 2½ days. It was also well known that Venus would transit the northern part of the Sun, during the forenoon of the 9th of Dec., 1874, (civil day at Greenwich), and would transit the southern part, 8 years less 2½ days later, or during the afternoon hours of the 6th of Dec., 1882. It was therefore evident, that it would pass north of the Sun, and very near it, 8 years less 2½ days before the first of these transits, and would approach nearest to the Sun, about 2 P. M., (Greenwich time), on the 11th of Dec., 1866, least distance of centres being about 38′ of arc, I therefore prepared to observe the Planet on the forenoon of that day.

My observations were made in the open air, on the grounds of the College of Charleston, with a telescope presented to the College, many years ago, by William Lucas, Esq. This telescope is a refractor by Troughton and Simms, 5 feet focal length, 3¾ inches aperture, eye-pieces used magnifying 70 and 120 diameters. I so placed my telescope, that the apex of the north gable, of the Library building, 23 yards distant, screened its object glass from the rays of the Sun, and the planet was easily found, and distinctly seen, above the roof of the Library, least distance of nearest limbs about 22′. To my surprise, even astonishment, I saw not merely two cusps prolonged, but the whole circumference completely enlightened, the disc of the planet, surrounded by a ring of light, broadest on side nearest to the Sun, narrower but quite bright, on the opposite side. To have additional testimony to this fact, I immediately called to witness it Messrs. E. T. Frost and W. St. J. Jervey, two students in my astronomical class ; they at once recognized the illuminated circumference, and said that it resembled in form, the annular eclipse of the Sun in Oct., 1865, which they had seen in this City, in the preceding year. As said above, I was at this time unacquainted with Mädler's observations and formulæ, and not having seen any intimation of the possibility of such a phenomenon, it took me wholly by surprise. I continued to watch the planet, from 9 to 11 A. M. when the Library building ceased to be available as a screen. This interval includes the instant of nearest approach of centres, which occurred about 9 hrs. 30 min. A. M. Charleston mean time.

As far as I can learn, the only other persons who saw the phenomenon at that time, were Prof. C. S. Lyman, of New Haven, Conn., and a few of his friends. In his equatorial of 9 inch aperture, he saw the annulus or ring, on the 10th, completely formed, but the line of light on the side farthest from the Sun, was slender, faint, and only seen by glimpses. He saw it again on the 12th, but did not attempt to observe it on the 11th, the day of conjunction, when I saw it as a brilliant ring of light. He doubtless would have succeeded perfectly, if he had abandoned the equatorial, which could not be screened, and used a more portable telescope, with some building as a screen.

In 1874 I watched the planet at intervals, from the 30th of Nov. to 12th of Dec., the transit taking place on the night of the 8th and 9th, Charleston civil time. On the 2nd of Dec. I saw, for the first time during this interval, the distinct prolongation of the cusps ; and watched their increase from day to day until the 8th, making eye-estimates of the number of degrees in the enlightened portion of the circumference, as I had not efficient means for making micrometer observations. On the 8th and the 9th, I fully expected again to see the annular phase, but failed entirely to find the planet on both days ; there were no clouds, at least not sufficient to entirely prevent observations, but there was a dense haze, and the region near the Sun was strongly illuminated.

At this transit, Mr. Lyman was more successful than myself, making good micrometer observations of the enlightened portion of the circumference, and seeing distinctly the illuminated ring on the 8th, the day before the transit.

On the 9th, he was like myself wholly unsuccessful in finding the planet ; but on the following days continued his micrometer measures. The results of these observations he published in *Am. Jour. of Sci. and Arts*, for Jan., 1875, with the amount of refraction in the atmosphere of Venus, deduced from his observations, and also Madler's formulæ by which it was deduced.

In Dec., 1882, the weather was so unfavorable on the day of the transit, the 6th, and for several days preceding and following, that I made no attempt to observe it before and after conjunction ; and no accounts of the observations of others have reached me ; but the scientific periodicals to which I have access are so few, that it would be unwarrantable to say that none have been made.

The next opportunity for observation will occur 8 years less 2½ days after the last transit, that is on the 3rd of Dec. next, when the least distance on centres will be about 35′, at about 18 hours Greenwich mean time. As Venus will pass south of the Sun, it will not be so easy to use buildings as screens, in the northern hemisphere, and special means must be devised. The luminous ring will be as bright and conspicuous as in 1866, and the first appearance on the prolongation of the cusps, may be looked for, about the 24th of Nov.

It is now evident that similar opportunities will happen on 1st of Dec., 1898, when least distance of centres will be about 1°, and about 28th of Nov., 1906, when least distance of centres will be about 1½°, the planet in both cases south of the Sun. In each case the least distance of centres will be less than the limit within which the formation of the luminous ring is possible, but the duration of the ring, will be successively less, as the least distance between centres becomes greater. No other opportunities will present themselves, until near the end of the next century, when they will occur in June.

Similar opportunities must have occurred in years preceding 1866, that is of 14th of Dec., 1858, and also on 16th of Dec., 1850, but it does not appear that either was used. This last date is only nineteen months after Madler's observations in May, 1849, and if any one properly situated as to time, had endeavored to repeat Mädler's observation on the day of conjunction, he would almost certainly have seen the luminous ring.

A letter of resignation from Dr. C. W. Kollock was read and the Treasurer was requested to endeavor to induce its withdrawal.

Member Elected.

Mr. H. A. M. Smith.

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